THIRD FIVE-YEAR REVIEW REPORT
DRAFT

RIVERBANK ARMY AMMUNITION PLANT
CITY OF RIVERBANK
STANISLAUS COUNTY
CALIFORNIA

PREPARED BY:

U.S. Army Corps of Engineers
Sacramento District
July 2011

Approved by: Date:

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U.S. Department of the Army

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U.S. Environmental Protection Agency

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List of Acronyms

AGSC	Ahtna Government Services Corporation
Ahtna	Ahtna Engineering Services, LLC
ALCOA	Aluminum Company of America
AOC	Area of Concern
ARAR	Applicable or relevant and appropriate requirement
BRAC	Base Realignment and Closure (Commission)
bgs	Below ground surface
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of concern
COE	U.S. Army Corps of Engineers
DHS	Department of Health Services
DOD	Department of Defense
DTSC	California Department of Toxic Substances Control
E/P	Evaporation-percolation (ponds)
EDC	Economic Development Conveyance
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Provision
ESD	Explanation of Significant Differences
EW	Extraction well
FFA	Federal Facility Agreement
FOSET	Finding of Suitability for Early Transfer
FOST	Finding of Suitability to Transfer
FYR	Five-Year Review
gpm	Gallons per minute
GWTP	Groundwater Treatment Plant
GWTS	Groundwater Treatment System
IC	Institutional Controls

IGWTS	Interim Groundwater Treatment System
IWTP	Industrial Waste Treatment Plant
LLNL	Lawrence Livermore National Laboratory
LUC	Land Use Controls
MCL	Maximum contaminant level
µg/L	Micrograms per liter
MW	Monitoring well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NI	Norris Industries
NPL	National Priorities List
O&M	Operation and maintenance
OSHA	Occupational Safety and Health Administration
PHG	Public Health Goal
POC	Point of Control
QAPP	Quality Assurance Project Plan
QA/QC	Quality assurance/quality control
RAO	Remedial action objectives
RBAAP	Riverbank Army Ammunition Plant
RCLRA	Riverbank City Local Redevelopment Authority
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RWQCB	California Regional Water Quality Control Board, Central Valley Region
SLUC	State Land Use Covenant
SWMU	Solid Waste Management Unit
TPH	Total petroleum hydrocarbons
TTLC	California Total Threshold Limit Concentration
WDR	Waste Discharge Requirement

Executive Summary

The previous (second) Five-Year Review (FYR) for the Riverbank Army Ammunition Plant (RBAAP) in Riverbank, California was finalized in September 2006. The RBAAP was put on the Base Realignment and Closure (BRAC) list in 2005, and is undergoing closure and transfer to the City of Riverbank Local Redevelopment Authority. This is the third FYR for the RBAAP.

Overall, the groundwater extraction and treatment system and landfill cover remedial actions are functioning as designed and are operated and maintained in an appropriate manner. However, groundwater pump and treat specified in the ROD for chromium and cyanide removal has not been fully successful for removal of residual chromium in some areas (US Army, 2011), but appears to be more effective for cyanide removal. Therefore, Ahtna (AGSC, 2009) has recommended in situ chromium reduction for the site. An Explanation of Significant Differences (ESD #1) has been developed to describe this.

The Army is implementing land use controls (LUCs) / institutional controls (ICs) for the Riverbank Army Ammunition Plant through deed restrictions. An Explanation of Significant Differences (ESD #2) is being developed to describe these controls.

Appropriate health and safety and emergency response protocols are in place at the RBAAP facility and are being implemented properly to control risks. Immediate threats to human health and the environment have been addressed through the implemented groundwater remedy. The groundwater extraction and treatment system is operating and functioning as designed, with the exception of extraction wells EW104 and EW114, access to which has recently been regained. Containment of the contaminated areas has been achieved through establishment of inward gradients that limit migration of the groundwater plumes. Contaminant levels throughout the site have generally decreased. The groundwater remedial action is currently protective of human health and the environment, but deed restrictions are required for institutional control to prevent inappropriate use of the contaminated groundwater while the groundwater remediation is occurring. Presently, groundwater in the vicinity of RBAAP is not used for drinking water, as residents are on the municipal drinking water system. Stanislaus County has stated that applications for domestic water wells in the vicinity of RBAAP will be denied and applications for irrigation wells will be considered individually, but that the County has not received a water well application in the RBAAP area for approximately 10 years.

The deed restrictions would include a restrictive covenant on the landfill site and on groundwater usage. The Industrial Wastewater Treatment Plant will be addressed under the RCRA Permit closure requirements. At the time of transfer of the property, the deed restrictions will be incorporated into the transfer documents.

The landfill cap as installed is effective in containing contaminants by limiting infiltration of rainwater and preventing direct contact with soils. However, data suggest that the landfill cap may not fully satisfy the long term objective of protecting groundwater from chromium leaching; further investigation is recommended. Access controls at RBAAP, which consist of fencing, a manned gate and security patrols remain in place and are effective. The landfill remedy is currently protective of human health and the environment, but deed restrictions are required in order for the remedy to remain protective in the long-term after transfer of the property.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Riverbank Army Ammunition Plant		
EPA ID *(from WasteLAN)*: CA7210020759		
Region: 09	**State: CA**	**City/County: Riverbank / Stanislaus County**

SITE STATUS	
NPL status: ☒ Final ☐ Deleted ☐ Other (specify)	
Remediation status (choose all that apply): ☐ Under Construction ☒ Operating ☒ Complete	
Multiple OUs?* ☐ YES ☒ NO	**Construction completion date:** 09 / 29 / 1997
Has site been put into reuse? ☒ YES ☐ NO Portions of the facility have been leased to private tenants.	

REVIEW STATUS	
Lead agency: ☐ EPA ☐ State ☐ Tribe ☒ Other Federal Agency: U.S. Army	
Author name: Technical Team (see Section 6.1)	
Author title: Various (see Section 6.1)	**Author affiliation: U.S. Army Corps of Engineers**
Review period:** 03/01/2011 to 07 /31/2011	
Date(s) of site inspection: 05 /11 / 2011	
Type of review: ☐ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion ☒ Statutory	
Review number: ☐ 1 (first) ☐ 2 (second) ☒ 3 (third) ☐ Other (specify) __________	
Triggering action: ☐ Actual RA Onsite Construction at OU #____ ☐ Actual RA Start at OU#____ ☐ Construction Completion ☒ Previous Five-Year Review Report ☐ Other (specify)	
Triggering action date *(from WasteLAN)*: 09/ 22 /2006	
Due date *(five years after triggering action date)*: 09/ 22 / 2011	

* ["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, cont'd.

Issues:

Several Issues were identified during the third five-year review:

1. Land use controls on groundwater and landfill use have not been fully implemented.

2. Western extent of chromium plume in area of EW104 and EW114 is not well-defined.

3. Source of chromium upgradient of EW54B is not defined.

4. Landfill cap may not fully satisfy objective of protecting groundwater from chromium leaching.

5. Loss of monitoring wells in the A/A'-zone due to falling groundwater levels.

Recommendations and Follow-up Actions:

The following actions are required to correct these issues and ensure that protectiveness is maintained in the future:

1. Complete activities described in the draft final ESD#2 to formalize the ICs for the site.

2. Access to applicable wells was recently regained, so chromium plume should be defined as quickly as possible. Monitor other wells in vicinity and down gradient of EW104 and EW114 to better define the plume.

3. Better-define source areas for chromium contamination in the area upgradient of the EW54B.

4. Further investigate the causes of the persistent occurrences of chromium contamination above the cleanup goal in groundwater at landfill.

5. Evaluate monitoring program to determine if existing active wells are sufficient to monitor remedy performance over the long term.

Protectiveness Statement:

The landfill remedial action is currently protective, based on continued O&M and groundwater monitoring results, although persistent occurrences of chromium contamination above the cleanup goal in groundwater at the landfill warrants further investigation.

The groundwater remedial action is operating as designed, with the exception of extraction wells EW104 and EW114, access to which has recently been regained, and is currently protective. In situ chromium reduction has been recommended by the contractor to achieve the chromium remediation goal more quickly.

Since both of the remedial actions are currently protective, the overall remedy at the RBAAP is protective of human health and the environment in the short term. The remedy has achieved reduction in size of the chromium and cyanide plumes, and there has been no known exposure to potential receptors. Groundwater extraction and treatment has achieved reduction in the extent of contamination. There has been no known pumping of groundwater within the plume for beneficial use.

To ensure protectiveness in the long term, the Army must:

1. Formalize the institutional controls with deed restrictions that prevent inappropriate use of the landfill and prevent use of groundwater.

2. Monitor and install additional wells if necessary to determine the extent of the chromium plume downgradient of EW104 and EW114, particularly in the B and C monitoring zones.

3. Adjust groundwater treatment as necessary to address contamination at the downgradient edge of the chromium plume, particularly in the C-zone.
4. Further investigate potential source areas of chromium contamination, including upgradient of EW54B and near MW65A' at the landfill.

1.0 Introduction

The U.S. Army has conducted its third Five-Year Review of the remedial actions implemented at the Riverbank Army Ammunition Plant (RBAAP) in Riverbank, California. This review was conducted during March through July 2011. This report documents the results of the review. The U.S. Army was supported in performance of this five-year review by Ahtna Engineering Services (Ahtna) who is the Groundwater Treatment Plant (GWTP) operator through contract to the Army Environmental Center at San Antonio, Texas.

The purpose of the five-year review is to evaluate whether the selected remedy at a site remains protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in this five-year review report. In addition, five-year review reports identify issues found during the review and provide recommendations to address them.

This five-year review report is prepared pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action.

The U.S. Environmental Protection Agency (EPA) interpreted this requirement further in the NCP; the Code of Federal Regulations Part 40(40 CFR)§300.430(f)(4)(ii) states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

This is the third formal five-year review for the RBAAP, and generally covers the operational period from May 2006 through May 2011. Although the Army prepared an initial review report dated August 1996, the first formal five-year review was conducted in 2001. The triggering action for the first formal five-year review was the initiation of remedial action on the landfill at RBAAP on June 5, 1995. The first Five-Year Review Report was finalized on September 21, 2001 and the second Five-Year Review Report finalized in September 2006. This third five-year review was required because hazardous substances, pollutants, or contaminants remain at the RBAAP site above levels that allow for unrestricted use and unlimited exposure.

A site-wide ROD (2004) included the two response actions, one for the groundwater and one for the landfill. The selected groundwater remedy was increased extraction with treatment at the Interim Groundwater Treatment System (IGWTS). The selected landfill remedy was a final cover. No further action was needed for the evaporation-percolation (E/P) ponds because removal of zinc and TPH contaminated sediments was completed in 2003, prior to the ROD, which eliminated the need for additional remedial action.

2.0 Site Chronology

Table 1: Chronology of Site Events	
Date	**Event**
1980	The Army published an Installation Assessment that identified potential hazardous materials release sites at RBAAP.
1984 to 1986	A Contamination Survey was completed in three phases. Chromium and cyanide were identified in groundwater at concentrations exceeding background levels.
1987 to 1991	A three phase Remedial Investigation (RI) program was completed. The RI confirmed that chromium and cyanide were the only contaminants of concern in groundwater.
1989	Interim response action was initiated. Design of the Interim Groundwater Treatment System (IGWTS) was completed.
2/21/1990	RBAAP was added to the National Priorities List (NPL).
1990	Construction of the IGWTS was completed.
4/5/1990	The Federal Facilities Agreement was signed.
10/1991	IGWTS operation commenced with extraction from onsite wells.
12/1992	City of Riverbank water supply lines were extended to residential area west of RBAAP.
12/1993	Evaporation-Percolation (E/P) Ponds Removal Action was completed.
3/23/1994	The Record of Decision (ROD) was signed.
2/13/1995	Remedial design for the landfill cap was approved.
6/5/1995	Remedial action was initiated for the landfill.
10/3/1996	Construction of the landfill cap, including drainage systems, was completed.
11/1996	Construction of the expanded groundwater treatment system (GWTS) was completed.
9/15/1997	Final offsite groundwater extraction well of the initial remedial design was installed.
9/29/1997	Construction completion was achieved.
9/30/1997	A Preliminary Close Out Report was submitted and approved.
1999	Groundwater Treatment Plant (GWTP) operations went to ion exchange only operation for removal of both chromium and cyanide.
7/2001	The California Regional Water Quality Control Board (RWQCB) issued revised Waste Discharge Requirements (WDRs), Order No. 5-01-200.
9/21/2001	The First Five-Year Review Report was finalized.
6/21/2002	A Corrective Action Consent Agreement was signed between the California Department of Toxic Substance Control (DTSC) and the Army.
9/2005 – 11/2005	The 2005 Base Closure and Realignment (BRAC) Commission made recommendations for realignment and closure of the RBAAP on 8 September 2005. The BRAC Commission's recommendations became binding on 9 November 2005.
9/2006	The Second Five-Year Review Report was finalized.
11/2006	The GWTS Operations and Maintenance Plan Update was finalized.
9/2007-8/2008	GWTS off-line for one-year rebound test.
10/2007-5/2008	Geochemical Fixation In-situ treatability test performed.
3/2009	Final Environmental Assessment for BRAC 05 Disposal and Reuse of the Riverbank Army Ammunition Plant, California completed.
7/13/2009	Finding of No Significant Impact (FNSI) for BRAC 05 Closure of Riverbank Army Ammunition Plant signed.
3/31/2010	The former Riverbank Army Ammunition Plant Facility was closed pursuant to the Base Closure and Realignment Act of 2005.
4/2010	Final Finding of Suitability to Transfer (FOST) completed for Parcels 1, 1a, 2, 2a, and B. The FOST was amended in April 2011 to remove the Northwest Stormwater Reservoir.
3/2011	Final Explanation of Significant Differences (ESD) No. 1 completed.

3.0 Background

3.1 Physical Characteristics

The RBAAP facility is located at 5300 Claus Road, Riverbank, Stanislaus County, California. The Site is about 1 mile south of the Stanislaus-San Joaquin County boundary and approximately 10 miles northeast of the City of Modesto (Figure 1). RBAAP is a 173 acre facility that is comprised of large production buildings with numerous support buildings located to the north and west. The main plant consists of 145 acres situated in a primarily rural area, bordered on the east by pastureland and on the north, west and south by sparse residential areas (Figure 2). Four evaporation-percolation (E/P) ponds cover an additional 28 acres and are located on the banks of the Stanislaus River, which is approximately 1.5 mile north of the main plant (Figure 2). The topography of RBAAP and the surrounding area is flat valley land.

3.2 Hydrogeology

The shallow groundwater bearing zones underlying the Site are not currently used as drinking water sources. These zones have been designated as A, A', B, and C, and are summarized as follows (Ahtna, 2011):

• A – an unsaturated upper sand zone with average depth from 29 to 60 feet below ground surface (bgs); bottom 10 feet predominately clay and silt;

• A' – a partially to fully saturated, well-graded silty sand with average depth from 60 to 90 feet bgs and approximately 30 feet thick; bottom 10 feet predominately clay and thinly interbedded sand and silt;

• B – saturated, semi-continuous sand units interbedded with thin silt and clay layers with average depth from 90 to 120 feet bgs and approximately 30 feet thick; bottom 10 feet predominately sand and silty sand with isolated areas of silt and clay;

• C – saturated sand zone with an average depth from 120 to 150 feet bgs (approximately 30 feet thick).

The aquifer zones defined above are not hydraulically independent. The presence of discontinuous fine-grained sediment layers creates a complex flow pattern in the subsurface. The average groundwater flow direction beneath the Site is westerly. Vertical gradients between A'-, B-, and C-zones are reportedly small, although the regional drop in water levels results in fairly consistent downward gradients during the summer months (Ahtna, 2011).

Deeper water bearing zones are associated with drinking water resources, although there are no known wells currently being used for this purpose in the immediate vicinity of RBAAP. The shallowest of the deeper zones, designated the D-zone, consists of saturated coarse silt and clay from 150 and 195 feet bgs (approximately 45 feet thick), and gravel and clayey gravel below approximately 195 feet bgs. The D-zone is monitored by semi-annual sampling of five wells completed in the upper D-zone; since 1999 contamination has not been detected in the D-zone monitoring wells. If regional pumping for agricultural or domestic uses occurs, this could create seasonally strong downward gradients from the C-zone to the D-zone. A seasonal trend is observed in groundwater levels in hydrologic zones, where levels drop in the summer and recover in the winter; however, groundwater levels have not recovered to seasonal historic levels. Due to the overall trend of continued regional decline in the water table elevation, the A-zone is now nearly completely unsaturated for a large portion of the year, with the lower portion becoming saturated only during the late fall and winter seasons. Large amounts of precipitation in 2005 and 2006 did not reverse the decreasing groundwater elevation trends, indicating that long-term groundwater declines are due to increased regional extraction of groundwater in the area. In November 2009 groundwater elevations were generally three to four feet below those recorded in November 2005 in the A/A'-zone, B-zone, and C-zone (Ahtna, 2009).

3.3 Land and Resource Use

RBAAP was originally constructed by the Aluminum Company of America (ALCOA) as an aluminum reduction plant supplying the military. The facility was built under authority of the Defense Plant Corporation in 1942 and production of aluminum began in May 1943. The facility subsequently was closed in August 1944. In 1951, the plant was converted to a government-owned, contractor-operated installation for the manufacture of steel cartridge cases. Norris Industries, Inc. (NI) operated the installation for this purpose from 1952 to 2009. From 1951 until 2009 the RBAAP produced steel cartridge cases with production reaching peaks during the Korean and Vietnam conflicts. The primary industrial processes used at the facility during this period included electroplating, cleaning, and metal finishing.

The 2005 Base Realignment and Closure (BRAC) Commission made recommendations for realignment and closure actions for military installations on September 8, 2005, in conformance with the provisions of the Defense Base Closure and Realignment Act of 1990 (Base Closure Act), Pub. L. 101-510, as amended. These recommendations included the closure of the Riverbank Army Ammunition Plant. In the absence of Congressional disapproval, the BRAC Commission's recommendations became binding on November 9, 2005. The RBAAP installation property was determined to be surplus to U.S. Department of Army needs.

The City of Riverbank Local Redevelopment Authority (RCLRA), subject to specific equipment hold back and necessary environmental cleanup areas, is in possession of all of the former plant facility property by a lease from the Secretary of the Army dated April 1, 2010. The lease is for a 5 year term or until such time as certain portions of the property is conveyed to the RCLRA pursuant to an Economic Development Conveyance (EDC). The primary responsibility of the RCLRA under the lease is to provide protection and maintenance of the property until they acquire title. The RCLRA is also charged with operating and improving the facility as an industrial park, under the terms of their filed plan for economic development of the site. The estimated property transfer date is the end of calendar year 2011.

The general land use designation of the RBAAP is presently industrial. Various buildings at the facility have been leased out to private businesses that conduct a variety of light to heavy industrial activities (see Table 2 for some examples). Based on the available infrastructure and other property improvements, it appears likely that the future use of existing buildings will be light to heavy industrial and offices. The RCLRA Conceptual Land Use Plan indicates that some current open spaces at RBAAP may be developed for offices or retail use. The deed and the State Land Use Covenant (SLUC) will include provisions against residential use of the property.

Stanislaus County has stated that applications for groundwater use within the County are screened for proximity to areas of known contamination. Applications for domestic water wells within 500 to 1,000 feet of RBAAP will be denied, and domestic water well applications from RBAAP west to Terminal Avenue will be denied. Applications for irrigation wells will be considered individually. However, Stanislaus County has stated that the County has not received a water well application in the RBAAP area in approximately 10 years (Damin, 2011, personal communication, Attachment 6).

Table 2: Some Tenants of RBAAP

Tenant	Type of Business
Ceracon	Manufacturing of metal parts
LMC-West	Manufacturing of dust collection and nut harvesting equipment
C&N Machining, Inc.	Machine shop
Wholesale Services, Inc.	Wholesaler of propane
Leisure RV Storage	Recreational vehicle storage facility
Cingular Wireless	Telecommunications leasing of the water tower for antenna installation
Environmental & Lubrication Solutions, Inc.	Distributor of packaged lubrication products
Sierra Railroad	Shortline railroad
Riverbank Oil Transfer	Transfer of used waste oil
California Highway Technology	Manufacturing of steel reinforcement for highways and bridges
Berkeley Forge	Storage of industrial equipment

The RCLRA has as its primary objective to utilize the RBAAP land and make improvements to better the economic condition of the Riverbank community (City of Riverbank, 2008). This is to be accomplished by retaining and expanding the existing businesses and attracting new businesses on the RBAAP property to create a job-generating engine for the region.

3.4 History of Contamination

3.4.1 Groundwater

The U.S. Environmental Protection Agency (EPA) added RBAAP to the National Priorities List (NPL) on February 21, 1990, due to the presence of cyanide and chromium in groundwater, detected both on-post and off-post. The offsite contamination impacted or potentially impacted the domestic wells of 70 residences west of the facility. Sources of chromium contamination were identified as aboveground tanks that were part of the Industrial Waste Treatment Plant (IWTP), and to a lesser degree chromium contaminated brick debris located in the landfill. The IWTP has treated wastewaters generated from the electroplating, cleaning, and metal-finishing processes at the facility. These processes used zinc chromate solutions, so there is the potential for additional sources of chromium contamination in areas where these processes occurred. The original IWTP storage and equalization tanks were made of redwood, and are believed to have periodically leaked. Prior to the 1994 ROD, the Army installed an Interim Groundwater Treatment System (IGTS) and provided alternative drinking water sources to all affected offsite residences. In 1992, the Army completed the extension of the Riverbank City water system, which connected services to all potentially affected residents.

3.4.2 Landfill

The landfill comprises a 4.5-acre parcel that was used for surface and trench disposal and debris burning from 1942 to 1966. According to records from 1942 to 1966, the landfill at RBAAP was used for the incineration and disposal for paper, dunnage, oils, grease, solvents, hospital wastes, construction debris, and industrial sludges. In 1966, onsite disposal operations were discontinued, and the area was filled with dirt and construction rubble. Monitoring wells installed downgradient of the landfill indicated that the landfill was a likely source of cyanide and chromium contamination in groundwater. The cyanide contamination has been linked to the disposal of potliners from the aluminum reduction process on the southern portion of the landfill. Chromium contamination in this area of the facility has been traced to construction rubble, which included chromium contaminated bricks.

3.4.3 Evaporation-Percolation Ponds

The E/P ponds contained levels of zinc in excess of the California Total Threshold Limit Concentration (TTLC). The E/P Ponds had received various degrees of treated facility effluent since discharge to the ponds began in 1952, resulting in contamination of the pond sediments.

3.5 Initial Response

Beginning in 1980, the Army has conducted investigations of past plant operations at RBAAP under the Installation Restoration Program. Subsequent investigations led to RBAAP being placed on the NPL in February 1990 due to the chromium and cyanide concentrations found in groundwater. Prior to the ROD, three response (removal) actions were conducted at the Site. These removal actions are summarized as follows:

3.5.1 E/P Ponds Removal Action

A removal action was required at the ponds to address zinc contamination in the soils within the ponds. Between September and December 1993, the Army excavated approximately 1,120 cubic yards of contaminated soil and disposed of it in an approved offsite landfill.

3.5.2 Permanent Potable Water Supply Response Action

A response action was necessary to protect residents from potential exposure to groundwater contaminated with chromium and cyanide migrating downgradient of RBAAP to the west. Initially, the Army provided bottled water to residents potentially impacted by the contamination. To provide a permanent source of clean water, the Army extended the City of Riverbank's public water supply system into the residential areas west of RBAAP. In December 1992, residents were connected to the City's public water supply. In addition, the Army drilled deeper wells for a small number of residents that still wanted to use wells for irrigation purposes.

3.5.3 Interim Groundwater Treatment System Response Action

The Interim Groundwater Treatment System (IGWTS) response action was established as a non-time critical removal action to protect public health, welfare, and the environment and to mitigate further off-site migration of groundwater contamination. As part of the IGWTS response action, the Army converted a total of eight monitoring wells, four in the B-zone and four in the C-zone, to extraction wells. The treatment system, consisting of reduction/precipitation for chromium and cyanide removal followed by selective anion exchange for additional cyanide removal, was built in 1991, and full operation of the IGWTS began in October 1991.

In addition to these response actions, the landfill and the IWTP required housekeeping and maintenance activities. Most of the potliners and contaminated bricks were removed during rubble cleanup efforts in 1987. In addition, from 1973 to 1980, the IWTP was upgraded and the redwood tanks were replaced with concrete tanks. Several investigations have also been conducted at the facility under the Resource Conservation and Recovery Act (RCRA) program. On June 30, 1995, DTSC issued a RCRA Part B Hazardous Waste Facility permit for RBAAP. A subsequent Corrective Action Consent Agreement deferred any necessary cleanup associated with residual soil contamination at the IWTP until RCRA closure.

3.6 Basis for Taking Action

Besides the initial response actions described above, further remedial action was necessary to address groundwater in the A'-, B- and C-zone aquifers with chromium and cyanide concentrations exceeding state and federal drinking water standard maximum contaminant levels (MCLs). Potential exposures to groundwater through direct ingestion or showering were associated with significant human health risks. Additionally, monitoring wells installed downgradient of the landfill indicated that the landfill was a likely source of cyanide and chromium contamination in groundwater, as discussed above.

4.0 Remedial Actions

The following environmental orders/agreements are applicable to RBAAP: the Federal Facility Agreement between the Army, the EPA, and the State of California signed in April 1990; the Record of Decision for RBAAP approved in March 1994; and a Corrective Action Consent Agreement signed by the Army and DTSC in June 2002.

4.1 Federal Facilities Agreement

The Federal Facility Agreement (FFA) between the Army, the EPA, and the State of California (DHS and RWQCB) was signed in April 1990 and became effective June 1990. The purpose of the FFA included the establishment of a procedural framework and schedule for developing, implementing and monitoring appropriate response actions at the Site in accordance with CERCLA, the NCP, Superfund guidance and policy, RCRA, and State ARARs.

4.2 Remedy Selection

In accordance with CERCLA, the Record of Decision (ROD) established the remedial actions selected for RBAAP. The ROD was signed by the Army, USEPA, DTSC, and the Central Valley Regional Water Quality Control Board on March 23, 1994. This site-wide ROD included the two response actions, one for the groundwater and one for the landfill. The selected groundwater remedy was increased extraction with treatment at the Interim Groundwater Treatment System (IGWTS). The selected landfill remedy was a final cover. The remedy for the E/P ponds selected in the ROD was that no further action was needed. Removal of zinc and TPH contaminated sediments, prior to the ROD, eliminated the need for additional remedial action. The ROD documented the decision that no further action was required for the E/P ponds, although groundwater monitoring would continue in accordance with applicable waste discharge permits.

The ROD mentioned additional activities (termed "post-ROD actions") that may need to be addressed in the future. The potential post-ROD actions are discussed below in Section 4.5.

The development of remedial action objectives for RBAAP was aimed at protecting human health and the environment through specific goals. The remedial action objectives were as follows:

• Groundwater – Restore the groundwater in all water bearing zones to remediation goals;

• Landfill – Remediate the landfill to protect human health and the environment, including water quality.

The groundwater remediation goals were established as the state MCL for chromium of 50 micrograms per liter (µg/L) and the state and federal MCL for cyanide of 200 µg/L. Although the ROD concluded that action was not warranted to address human health risk based on exposure to landfill soils, in accordance with a Dispute Resolution Agreement, a final landfill cover was required to ensure that residual chromium in the soils did not impact groundwater. Based on these remedial action objectives, the remedial actions were selected for the groundwater and the landfill as discussed in greater detail below.

4.2.1 Groundwater

The groundwater remedy includes three major components:

• Groundwater extraction from wells located onsite and offsite to provide full capture of the chromium and cyanide A'-, B-, and C-zone plumes, as defined by the remediation goals of 50 µg/L and 200 µg/L, respectively;

• On-site treatment by chemical reduction and precipitation followed by ion exchange and treated groundwater discharge to the E/P Ponds;

• Long-term groundwater monitoring for chromium and cyanide to ensure that the remedy is effective.

The ROD did not specifically address action for A-zone groundwater because the A-zone was not saturated at the time. The A-zone is discussed below in Section 4.5, Post-ROD Actions.

4.2.2 Landfill

The landfill remedy included the following major components:

• Install a final cover in accordance with the substantive provisions of California Code of Regulations (CCR), Title 23, Chapter 15, Articles 5 and 8, Corrective Action and Closure Requirements and maintain the cover for 20 years.

• Install additional monitoring wells down gradient of the landfill.

The landfill cover design includes a two-foot-thick vegetative cover layer, a one-quarter-inch-thick geosynthetic clay liner, and a two-foot-thick foundation layer. The landfill cap was designed to drain rainfall off and away from the landfill.

4.3 Remedy Implementation

The U.S. Army Corps of Engineers contracted with CH2M Hill to complete the remedial design of the selected remedy, both for the landfill and the groundwater extraction and treatment system. Implementation of the selected remedies is discussed below.

4.3.1 Groundwater

Implementation of the groundwater remedial action system actually began before the ROD with operation of the IGWTS, which was constructed in 1990 and brought on-line in October 1991. The IGWTS was used initially to provide capture and treatment of contaminated groundwater flowing westward across the installation boundaries. The original extraction system consisted of a series of extraction wells clustered at four locations on the RBAAP property all feeding into the IGWTS which was designed to treat 80 to 100 gallons of groundwater per minute. As required under the ROD, the IGWTS was retained as an integral part of the final groundwater treatment system based on its demonstrated performance.

Following the ROD, remedial design for the groundwater extraction and treatment system began in 1994 and was completed in June 1995, as presented in the Groundwater Extraction and Treatment System 100 Percent Design Document (CH2M Hill, 1995). Extraction system design and operating criteria are described in the Final Extraction System Design and Monitoring Plan (CH2M Hill, 1997).

The Army modified the groundwater extraction system to include extraction wells west of the RBAAP facility designed to provide full capture of the chromium and cyanide plumes. This entailed construction of 6 new off-base extraction wells. Concurrently, the Army constructed the GWTS, with a design capacity of approximately 250 gpm, to supplement the IGWTS. During design and construction of the GWTS, the Army upgraded the IGWTS to increase its capacity to 120 gpm to allow immediate hookup of the off-base (areas beyond the RBAAP boundary) extraction wells, thereby expediting plume capture. Expansion of the overall groundwater treatment plant (consisting of the IGWTS and the GWTS) to handle increased pumping from the expanded extraction system was completed in November 1996. The final extraction well was installed and operating in September 1997.

From 1997 until October 2005, extracted groundwater at RBAAP was treated using a combination of the IGWTS and the GWTS. The IGWTS was deactivated in October 2005 as part of system optimization efforts, and since then the GWTS has handled all groundwater recovered by the extraction wells.

Treated effluent is to be discharged to either the Oakdale Irrigation District (OID) Canal or the E/P ponds. Long term monitoring is to be conducted to demonstrate the effectiveness of the extraction and treatment system in fully capturing the plumes and meeting defined discharge limits of less than 50 µg/L for chromium and 5.2 µg/L for cyanide for the E/P ponds, and less than 11 µg/L for chromium and 5.2 µg/L for cyanide for the OID Canal.

4.3.2 Landfill

The RBAAP remedial design was started in 1994 with the preparation of the Closure and Post-Closure Maintenance Plan. This document presented the remedial design for landfill closure. According to the Plan, access to the RBAAP site will be restricted to employees and authorized vehicles at all times. Although the landfill is not fenced separately, the entire RBAAP property is fenced, gated at all points of access, and all visitors are required to check in at the main gate. The RBAAP is monitored 24-hours a day, 7 days a week. Warning signs are in place about every 150 feet at the landfill.

The EPA approved the remedial design for the landfill on February 13, 1995. The remedial action includes routine groundwater monitoring around the landfill to check that the remedial action is effective and that the cleanup objectives are being met. The Closure and Post-Closure Maintenance Plan was subsequently modified and finalized in May 1996, after landfill cover construction was complete. Following installation of the cap and associated drainage and final grading, the cover was hydro-seeded with native grass. Construction of the landfill remedial action was completed in October of 1996 (CH2M Hill, 1996).

4.4 System Operations

Norris Industries (NI) was the operating contractor for the RBAAP facility, and until 2004, the Army had contracted with NI to perform operations and maintenance (O&M) activities for each of the remedial actions constructed at RBAAP. NI operated the IGWTS and the onsite extraction well system since operations started in 1991, and continued in this role through the system expansion, including the addition of the GWTS and offsite extraction well system in 1996. They also performed the routine landfill O&M activities through 2004.

Ahtna Government Services Corporation (AGSC), whose name was change to Ahtna Engineering (Ahtna) in 2009, was contracted by the Army to replace NI as the O&M contractor for the RBAAP in 2004. As a part of this role, AGSC took over O&M for the GWTS, including onsite and offsite extraction wells, and the landfill.

Current O&M activities reflect modifications to the system since 2004 when AGSC assumed O&M responsibilities. System operation and monitoring requirements are discussed below.

4.4.1 Groundwater

Groundwater treatment system operations and maintenance includes:

- Daily monitoring of treatment plant and extraction system operations.
- Ongoing maintenance of the groundwater extraction and treatment systems in accordance with the 2006 O&M Manual Update. System maintenance comprises three main components: routine preventative maintenance, minor equipment maintenance and repair, and major equipment repair/replacement.

• Quarterly, semiannual, or annual sampling of groundwater monitoring wells, and monthly groundwater elevation measurement of certain wells. Groundwater monitoring reports are produced quarterly.
• Monthly sampling of GWTP influent.
• Monthly sampling of the GWTS ion exchange column effluent and the final effluent discharged to the E/P ponds.

The GWTP is staffed full-time during the day, Monday through Friday, and occasionally on Saturday and Sunday. In addition, an autodialer emergency alarm system that offers onsite and remote monitoring capability for operation of the GWTP was installed in 2004. This system is connected to a telephone line and responds by dialing up to four separate telephone numbers to provide notice of potential system failure.

Routine daily O&M tasks include, but are not limited to, the following:
1. Monitor extraction well and influent pump flow rates, and adjust as necessary.
2. Monitor pressures across the multimedia filters and ion exchange columns.
3. Conduct ion exchange regeneration and backwashes as needed, and operate the regenerant evaporator.
4. Prepare and submit work orders as needed for the repair of GWTP equipment.
5. Operate the backwash system for the multimedia filters as needed.
6. Perform routine housekeeping for maintenance of the facility.
7. Record pertinent operational data, including totalizer readings and flow rates.

Groundwater extraction and treatment system maintenance has primarily been limited to routine system maintenance and repairs. Operational costs including the GWTS, the groundwater sampling and monitoring program, landfill maintenance and leases were approximately $1.0 million in 2010, with similar per year costs in previous years. These costs are within the expected range for the listed activities.

The groundwater plume is monitored through quarterly groundwater sampling. The results of the groundwater sampling from the fourth quarter 2010 are shown in Figures 3 through 6 (Ahtna, 2011).

From September 2007 through August 2008, the GWTS was off-line to conduct a groundwater contaminant rebound study in order to determine the effectiveness of the GWTS and to guide future system improvements (AGSC, 2009). The GWTS continued to be off-line until summer 2009 due to a lapse in the operation and maintenance contract. Further discussion of the rebound test may be found in Section 6.4.

4.4.2 Landfill

Landfill operations and maintenance includes:
• Groundwater monitoring downgradient of the landfill to evaluate effectiveness of the cover and migration of contaminants.
• Surface water runoff monitoring.
• Final cover monitoring, including monitoring and maintenance of vegetative cover growth, surface erosion, and settlement and grading.

• Surface water drainage monitoring and maintenance.

Landfill maintenance has generally been limited to routine mowing and weed control, and occasional re-vegetation, repairs of minor erosion, and drainage system repairs. Landfill O&M activities are reported on a quarterly frequency.

4.5 Post-ROD Actions

The ROD described two conditions that, although not part of the selected remedy may need to be addressed, based on events that may occur after implementation of the ROD. These conditions are (1) recharge of the A-zone aquifer, and (2) investigation of the IWTP source area upon its closure. These potential actions are discussed below.

4.5.1 Recharge of the A-Zone

The ROD calls for continued monitoring of the A-zone to determine if it recharges, and if it does recharge, investigation of the extent of contamination. If groundwater concentrations were to exceed the MCL cleanup levels, the A-zone groundwater would then be remediated, as necessary. To date, the A-zone has not recharged and groundwater levels, while varying seasonally, continue to fall.

4.5.2 Industrial Waste Treatment Plant Source Investigation upon Closure

The IWTP was identified as a source of chromium contamination in the groundwater during the Remedial Investigation (RI). Investigations conducted around the IWTP tanks determined that the residual contamination in these soils did not represent a threat to groundwater. However, because the IWTP is an operating system, investigations were limited to the perimeter of the tanks. In accordance with RCRA closure requirements and the 2002 Corrective Action Consent Agreement, the Army will perform a more complete investigation of the IWTP area upon RCRA closure to ensure that potential impacts to the environment are mitigated.

The RBAAP facility is being closed under BRAC and completion of RCRA-related activities is expected soon. The quitclaim deed and State Land Use Covenant (SLUC) will include a restriction that prohibits any excavation activities (i.e. digging, drilling, or any other excavation or disturbance of the land surface or subsurface) at the IWTP until closure activities are complete.

5.0 Progress since the Last Five-Year Review

The second Five-Year Review Report concluded that the landfill and groundwater remedies for RBAAP were protective of human health and the environment, and identified several issues that should be addressed to maintain the long-term effectiveness of the remedies (AGSC, 2006). None of these were sufficient to warrant a conclusion that the remedy is not protective. Some of the issues could affect the long-term performance of the remedy. These issues, associated recommendations, and status are given below:

1. There are no institutional controls in place for the landfill area to prevent inappropriate uses in the future that could impact the integrity of the cap.

Recommendation: If RBAAP closure proceeds, implement deed restrictions.

Status: RBAAP closure has occurred and property transfer is planned. Deed restrictions will be implemented at property transfer. See additional discussion below.

2. There are no institutional controls in place to ensure that no inappropriate use of contaminated groundwater occurs while the groundwater remediation is occurring. However all potentially affected residences have been provided with a public water supply for domestic use as part of the Permanent Potable Water Supply Response Action and which limits groundwater use to irrigation only.

Recommendation: If RBAAP closure proceeds, implement deed restrictions.

Status: RBAAP closure has occurred and deed restrictions will be implemented at property transfer as described in ESD#2. In addition, Stanislaus County has implemented procedures within their water well permitting process to restrict installation of wells for water supply. See below for additional discussion.

3. EPA approval of the O&M Manual Update has not been obtained, as required.

Recommendation: Submit O&M plan update to EPA for review and approval.

Status: The O&M plan update was submitted to the EPA for review in 2006 and was finalized by AGSC in November 2006.

4. Landfill O&M, specifically including the twice annual surface water monitoring, was not performed during the 2004 to 2005 season. Landfill reports were also not always being prepared and submitted on a semi-annual basis, as required.

Recommendation: Review the formalized landfill O&M procedures implemented by AGSC to ensure compliance.

Status: Landfill O&M reports are produced and submitted semi-annually.

5. Rodent burrows at the EW113 extraction well cluster may lead to undermining of these structures.

Recommendation: Restore the area around the EW 113 wells and implement burrow monitoring and abatement, as necessary.

Status: Rodent abatement program was initiated.

6. Community members would like more information regarding the implications of the proposed closure and the status of the remedial actions.

Recommendation: Prepare a factsheet updating community on status of site remediation.

Status: Information has been supplied to the community periodically and documents deposited at the Riverbank Branch of the Stanislaus County Library.

7. The Army's onsite information repository did not have all required documents readily available. Documents not located included quarterly groundwater monitoring reports, quarterly landfill reports, and monthly GWTS reports.

Recommendation: The information repository currently is being updated so that documents are readily available.

Status: Document repository is maintained at the Stanislaus County Library, Riverbank Branch 3442 Santa Fe Avenue, Riverbank, California.

Additional discussion on progress since the last five-year review is provided below.

5.1 Operation and Maintenance Plan Update

The Groundwater Treatment System Operation and Maintenance Plan Update (O&M Plan Update) was finalized in November 2006. This update to the O&M Plan was prepared to identify operational requirements for the water treatment system. It describes the operational requirements for both the formerly operated IGWTS and the presently operated GWTS. The O&M Plan also identifies the requirements for operating the groundwater extraction system, in conjunction with treatment plant operations. Many of the treatment systems located in the plant are components of the IGWTS and are no longer in operation. The O&M Plan identified those portions of the plant that continue to be in operation.

5.2 Explanation of Significant Differences #1

The Army has prepared an Explanation of Significant Differences (ESD #1, March 2011) to:

- Present the rationale for modifying the remedy identified in the ROD for the treatment of chromium contaminated groundwater;

- Describe the treatment modification.

Supplemental groundwater characterization was performed in 2006 to support optimization of the groundwater remedy (SOTA/CH2MHill, 2007). Further discussion of that effort is provided in Section 6.4.1.

In September 2007, the Army initiated a one-year shutdown of the groundwater pump and treatment system to study rebound effects, as described in Section 6.4.2 below. The Army also conducted an in situ pilot test of ferrous iron and carbon to determine if this could result in an alternative treatment of residual hexavalent chromium in the groundwater, as described in Section 6.4.2 below. The localized contamination indicated by the supplemental investigation, and plume stability indicated by the results of the rebound study, support localized in situ treatment for the remaining areas of chromium contamination. The results of the in situ pilot test demonstrated that reductant injections rapidly reduced dissolved chromium concentrations by precipitating trivalent chromium. To reach the remediation goal of 50 μg/L for chromium defined in the ROD, a modified remedial approach is needed. Based on these results, in situ chromium reduction was recommended for the A'-, B-, and C-zones of the aquifer (Ahtna, 2010).

Pumping groundwater and treating it at the GWTS have reduced groundwater cyanide concentrations from a maximum of 22,600 μg/L in 1993 to a maximum of 320 μg/L in the Second Quarter of 2010 (AGSC, 2006; Ahtna, 2010). The plume was also significantly reduced in size by operation of the GWTS. The rebound study showed cyanide concentrations are effectively captured by GWTS operations. The ROD-selected remedial action remains effective for cyanide, so it was recommended that this remedial action continue to be used to treat groundwater contaminated with cyanide at concentrations above the MCL, and continue to be used to contain chromium plumes until the in situ treatment design is implemented.

5.3 Explanation of Significant Differences #2

The previous Five-Year Review stated that "The Army has implemented, maintained and enforced land use controls (LUCs) /Institutional Controls (ICs) consistent with the selected remedial actions in the 1994 Record of Decision for the Riverbank Army Ammunition Plant. To address the comments on the Draft second five-year review related to LUC/IC issues and as previously planned, the Army will develop a document to serve as a Property Management Plan to address all relevant and necessary LUCs associated with the RBAAP remedial actions as described in the ROD and/or with the existing RCRA Permit." To this end, the Army has prepared an Explanation of Significant Differences (ESD #2) to address institutional controls on the use of contaminated groundwater at the RBAAP that were developed and implemented after the ROD was signed in 1994. Institutional controls will be included in the quitclaim deed to maintain protection of human health and the environment. The institutional controls include (1) prevention of access or use of the groundwater until remedial action objectives are met, and (2) maintenance of the integrity of current or future remedial monitoring systems such as groundwater extraction and treatment systems, in situ treatment systems, and monitoring wells.

The environmental restrictions that the United States is required to include in its quitclaim deed for any property known to have had hazardous substances released or disposed of on the property, are included in CERCLA 120(h)(3). Each transfer of fee title from the United States will include a CERCLA 120(h)(3) covenant that will have a description of the residual contamination on the property and the environmental use restrictions, expressly prohibiting activities inconsistent with the performance measure goals and objectives.

In accordance with CERCLA, each deed will also contain a reservation of access to the property for the Army, the USEPA, the DTSC and the Regional Water Board, and their respective officials, agents, employees, contractors, and subcontractors for purposes consistent with FFA. The deed will contain appropriate provisions to ensure that the restrictions continue with the land and are enforceable by the Army or its designees.

5.4 Finding of Suitability to Transfer

The purpose of the Finding of Suitability to Transfer (FOST) is to document the environmental suitability of certain parcels at RBAAP for transfer consistent with CERCLA and DOD policy. The FOST was finalized by the Army in April 2010 but amended in April 2011 to remove the Northwest Stormwater Reservoir, and includes the CERCLA Covenant, and Access Provisions and other Deed Provisions and the Environmental Protection Provisions (EPPs) necessary to protect human health or the environment after transfer.

Approximately 60 acres are included in the FOST. This FOST covers Parcels 1, 1a, 2, 2a, and B. These parcels contain areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that did not require a removal or remedial response.

The deed will include a land use control for groundwater on the property. The land use control will restrict groundwater use and the unauthorized alteration/disturbance of the active remediation system and the existing monitoring well network located within the boundaries of the RBAAP property. All monitoring and extraction wells are secured with locks and access to the installation is controlled by fencing and plant security personnel. No activities or actions that will damage the well heads, vaults, casing, or compromise the overall integrity of monitoring wells shall be allowed on the property. In addition, the property recipient(s) will be required to sign a State Land Use Covenant (SLUC) with DTSC and the Central Valley Regional Water Quality Control Board (Central Valley Water Board). The SLUC will be signed by the transferee(s) and recorded within 10 days of the Property's transfer by deed.

The FOST contains the following environmental protection provisions to be included in the deed to ensure protection of human health and the environment:

> ***1. FEDERAL FACILITIES AGREEMENT***
> *The Grantor acknowledges that the Riverbank Army Ammunition Plant has been identified as a National Priorities List (NPL) site under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended. The Grantee acknowledges that the Grantor has provided it with a copy of the Riverbank Army Ammunition Plant Federal Facility Agreement (FFA) dated April 5, 1990. For so long as the Property remains subject to the FFA, the Grantee, its successors and assigns, agree that they will not interfere with United States Department of the Army activities required by the FFA. Pursuant to and as provided in Section 25 of the FFA, the Grantee shall provide access to the EPA, the State, and their authorized representatives for purposes consistent with the FFA.*
>
> ***2. LAND USE RESTRICTIONS***
> ***A.*** *The United States Department of the Army has undertaken careful environmental study of the Property and concluded that the land use restrictions set forth below are required to ensure protection of human health and the environment. The Grantee, its successors or assigns, shall not undertake nor allow any activity on or use of the property that would violate the land use*

restrictions contained herein.

(1) Residential Use Restriction. *The Grantee, its successors and assigns, shall use the Property solely for commercial or industrial activities and not for residential purposes. For purposes of this provision, residential use includes, but is not limited to, single family or multi-family residences; child care facilities; and nursing home or assisted living facilities; and any type of educational purpose for children/young adults in grades kindergarten through 12.*

(2) Groundwater Restriction. *Grantee is hereby informed and acknowledges that the groundwater under the Property has low level detections of chromium and cyanide that are below Maximum Contaminant Levels. The Grantee, its successors and assigns, shall not access or use ground water underlying the Property for any purpose without the prior written approval of United States Department of the Army, the U.S. Environmental Protection Agency, Region 9, the Department of Toxic Substances Control, and the Regional Water Quality Control Board, Central Valley Region. For the purpose of this restriction, "ground water" shall have the same meaning as in section 101(12) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).*

(3) Notice of Groundwater Monitoring Wells*. The Grantee is hereby informed and does acknowledge the presence of 29 groundwater monitoring wells on the Property. The Grantee, its successors and assigns shall not disturb or permit others to disturb the monitoring wells located on the Property without prior written approval from the Grantor, the U.S. Environmental Protection Agency, Region 9, the Department of Toxic Substances Control, and the Regional Water Quality Control Board, Central Valley Region. Upon the Grantor's determination that a well is no longer necessary, the Grantor will close such well at the Grantor's sole cost and expense in accordance with applicable laws, regulations, and ordinances.*

5.5 Finding of Suitability for Early Transfer

The purpose of the Finding of Suitability for Early Transfer (FOSET) is to document the environmental suitability for transfer consistent with CERCLA of approximately 108 acres at the RBAAP. CERCLA requires the United States to provide a covenant in the deed conveying the property warranting that all remedial action necessary to protect human health and the environment has been taken prior to the date of transfer. CERCLA allows the covenant requirement to be deferred with "Early Transfers," and the United States will provide the warranty after transfer when all the response actions necessary to protect human health and the environment have been completed. The period between the transfer of title and delivery of this final warranty is the deferral period. The intent of the Early Transfer is to facilitate efforts to stimulate the economy through the timely and efficient reuse of the Property while maintaining protection of human health and the environment throughout the transfer, cleanup, and redevelopment processes.

The areas covered by the FOSET include the E/P ponds, Northwest Stormwater Reservoir, and Remainder Parcel A, which includes the manufacturing area, the landfill, the IWTP, and the groundwater. The FOSET is currently in draft form. Finalization of the FOSET is expected in September 2011.

6.0 Five-Year Review Process

6.1 Administrative Components

The first Five-Year Review Report was finalized on September 21, 2001 and the second Five-Year Review Report finalized in September 2006. This third five-year review was required because hazardous substances, pollutants, or contaminants remain at the RBAAP site above levels that allow for unrestricted use and unlimited exposure. The Riverbank community was notified of the start of the five-year review and community input requested by publication of a notice in a local newspaper. The third RBAAP five-year review was performed by the U.S. Army Corps of Engineers with the following team members:

- Jim McAlister, Project Manager
- Patrick Plumb, PE, Environmental Engineer
- Doug MacKenzie, PE, Senior Environmental Engineer
- Heather Jackson, EIT, Environmental Engineer, Technical Team Lead
- Cory Koger, PhD, Environmental Toxicologist
- Marc Sydow, RG, Geologist

Ahtna Engineering (Ahtna) provided support for the five-year review as the GWTS operator while under contract to the Army Environmental Center at San Antonio, Texas. Lewis Mitani of the USEPA assisted in the review as the representative for the support agency.

The third five-year review consisted of the following activities: interviews with Army staff, contractors, the support agency and others, both at RBAAP and by telephone; a review of relevant site documents; a site inspection; and a review of applicable or relevant and appropriate requirements (ARARs) and exposure pathways. The final report will be placed in the information repository.

6.2 Community Notification

Community notification of the five-year review was accomplished by publication of a public notice in the Modesto Bee on May 15, 2011. Community input was requested in the notice, with Army and USACE contact phone numbers provided. The public notice as it was published is given in Attachment 4.

6.3 Site Inspection and Interviews

The U.S. Army Corps of Engineers, Ahtna Engineering, and the U.S. EPA took part in a site inspection on May 11, 2011. During these activities, remedial systems were inspected and treatment plant operations were observed. The inspection evaluated the landfill cap, groundwater treatment system, surface water drainage system, facility fencing, and parts of the groundwater extraction system. A summary of the site inspection findings is presented below. (Please refer to Attachment 1 for the site inspection checklist that details the inspection findings. Attachment 8 contains photos documenting site conditions observed during the site inspection.)

The weather during the inspection was sunny with high temperatures in the low 70's. The entire facility is fenced in with one entrance point, which is guarded. Only authorized personnel are allowed to enter the facility. Access is also controlled by security patrols.

The landfill has a barbed wire topped fence with warning signs approximately every 150' feet on one side of the landfill, which serves as the RBAAP boundary as well. Some signs are in need of repair to make them more visible. No issues were identified with respect to the RBAAP facility fencing in the landfill vicinity, or other areas of the facility inspected.

The vegetation on the landfill had not been cut recently, since it was due for its biannual mowing in early July. The heavy vegetation made it difficult to observe the condition of the landfill cap. Vegetation covered the entire landfill cap with no distressed areas noted. No holes were evident in the landfill surface. The plant operator had noted in his last weekly inspection that the landfill cap was in good condition. This assessment is consistent with observations made during the site inspection.

The GWTP was found to be operating and functioning properly. No operational problems were observed. Since closure of the IGWTS in 2006, the GWTP uses only ion exchange, which involves straightforward operational procedures. The primary operator activities are to regenerate the resin in the ion exchange columns when it is spent, and perform water quality monitoring and analysis. The O&M manual was updated in 2006 and includes schematic representations of the current system.

The groundwater extraction well vaults inspected were intact with no signs of damage. However extraction wells EW104B, EW114B, and EW114C are not in operation and could not be inspected because the landowner has denied USACE right of entry. The remaining six groundwater extraction pumps were extracting water from the A' and B zones, with a total combined extraction rate of approximately 90 gpm.

Security records for the landfill and GWTP are maintained on both the daily operations report and the weekly operations report by the Ahtna treatment plant operator. When the treatment plant operator is not in attendance at the GWTP, the facility is secured and locked. Weekly inspections of the landfill and landfill cap are conducted by the GWTP operator and documented on inspection checklists. There have been no security breaches at the GWTP or the landfill over the past five years.

As part of the site inspection, interviews were conducted with the following people: Rachel Kerr, the task manager of the RBAAP project for Ahtna; Joseph Valenzuela, groundwater treatment plant operator for Ahtna; Lewis Mitani, U.S. EPA Remedial Project Manager; and

Clark Hunt, RBAAP security and safety specialist. Robert Smith, the Commander's Representative and Base Environmental Coordinator for RBAAP and Nicole Damin, Stanislaus County, were interviewed by phone at later dates. Marcus Pierce from the CVRWQCB and Jim Pinasco from the DTSC chose to provide input as written comments on the draft FYR to convey their current assessment of the ROD remedies. Summaries of the interviews are provided in Attachment 6.

6.4 Document and Data Review

Documents reviewed for the third five-year review are listed in Attachment 2. The Army, through Ahtna, the GWTP operator, recently performed studies of the effectiveness of the groundwater pump and treatment system. Those studies involved significant data review and the conclusions are summarized in Sections 6.4.1 through 6.4.3 below. Additional data review is also described below.

6.4.1 Supplemental Groundwater Characterization

Supplemental groundwater characterization was performed in 2006 to support optimization of the groundwater remedy (SOTA/CH2MHill, 2007). Groundwater samples were collected in the A/A' and B zones primarily with direct-push technology in order to better understand the distribution of contamination providing the sources of the persistent groundwater contamination. The A/A' zones were sampled at 29 locations, and the B zone was sampled at 6 locations. The locations and results are provided on Figures 7 and 8.

Chromium was detected in only three samples, two of them in the B zone. One of those detections was above the MCL at 127 µg/L and was located adjacent to the west wall of the production facility, directly up-gradient of EW54B, which continues to be one of the more highly contaminated wells on the site. The report concluded that "…elevated chromium being extracted from MW54B is migrating vertically into the B zone considerably upgradient, potentially under the historic production plant or the IWTP area." It also concluded that the limited aerial extent of contamination lent itself to cost-effective in-situ treatment.

Cyanide was detected in 18 of the 21 A/A' Zone locations tested, with 4 of those detections above the MCL. The report recommended more aggressive actions to accelerate cleanup, including locating soil contamination in limited areas, increased A' zone groundwater extraction, or in-situ methods.

6.4.2 Rebound Study

In September 2007 through August 2008, the Army initiated a one-year shutdown of the groundwater pump and treatment system to study chromium and cyanide rebound. As part of this effort, the Army installed four new monitoring wells (MW117, MW118, MW119, and MW120).

During this study, chromium concentrations in most monitoring wells did not increase, indicating that major residual chromium inputs to groundwater are not likely to remain. However, increases in chromium concentrations during the winter months at wells MW34A', MW65A', and MW117A' were thought to be due to desorption of chromium in unsaturated soils as seasonal water level fluctuations bring water levels back up. Also, chromium concentration increases at MW116A', MW118B, and EW114B were attributed to desorption or diffusion of chromium from residual sources. For cyanide, localized residual inputs were seen at EW63A' and attributed to cyanide desorption (AGSC, 2009). An alternative explanation for significant increases in cyanide concentrations at EW63A' is that this extraction well is located near the center line of the plume, and by stopping extraction, lower concentration water is no longer drawn toward the well to dilute the concentration.

The rebound study confirmed that the current GWTS is effective at treating cyanide in groundwater, but may have little additional impact on reducing chromium concentrations in localized areas (AGSC, 2009). This study concluded that the GWTS alone may not be able to reduce chromium concentrations to below the MCL in localized areas, and to reach the remediation goal of 50 μg/L for chromium defined in the ROD, a modified remedial approach is needed.

6.4.3 In Situ Pilot Test

A pilot test was conducted at RBAAP to evaluate the effectiveness of using organic carbon and ferrous iron for in situ treatment of chromium contaminated groundwater (AGSC, 2009). Results indicated there was a sustained treatment for a minimum of six months, with a rapid reduction of dissolved chromium to below the MCL by the precipitation of low solubility trivalent chromium.

Based on these results, in situ chromium reduction was recommended for the A'-, B-, and C-zones of the aquifer. In situ treatment in the A-zone is not planned as the A-zone is dry for the majority of the year and the proposed in situ treatment cannot be applied to unsaturated zones. In situ treatment in the D-zone is unnecessary as chromium has not been detected in the D-zone since 1999 (Ahtna, 2010). Full-scale in situ treatment is planning stages and has not been implemented.

6.4.4 Groundwater Data

The groundwater is monitored through quarterly, biannual, and annual groundwater sampling, depending on the well being sampled. Wells that consistently detect contamination are sampled on a quarterly basis. The results of the groundwater sampling from the fourth quarter 2010 are given in Figures 3 through 6 (Ahtna, 2011), which show recent groundwater elevations and isoconcentration contours for chromium and cyanide in the A-A', B, C, and D zones, respectively (Ahtna, 2011).

Seasonal fluctuations in groundwater elevations in the A-A' zone wells 49A and 52A abruptly ceased about July 2009, and seasonal fluctuations in these wells have not resumed. This is likely due to the groundwater level in the A aquifer falling to the bottom level of the well screen, and the subsequent measurement of the level of the residual water in the well sump. As the regional groundwater levels continue to fall, fewer A-A' wells are available for monitoring groundwater conditions at the site.

Following shut down of the GWTP from about September 2007 through August 2008 for completion of the rebound study discussed in Section 6.4.2, the GWTP continued to be non-operational from about September 2008 until about August 2009 because no contract for plant operation was in place.

Currently, the RBAAP Site has 140 monitoring wells, with 102 wells listed as scheduled for periodic sampling. However, at least 20 wells in the A/A'-zone are dry or do not have enough water to collect a sample. There are 6 active extraction wells, and 3 extraction wells that are not operating due to access restrictions. Access to the extraction and monitoring wells on property west of the site has been denied by the property owner, so monitoring and treatment of the groundwater from EW104B, EW114B, EW114C and MW104C has not been conducted recently, with the last monitoring event in March 2010, and the extraction wells shut down in May 2010 (EW114B and EW114C) and June 2010 (EW104B).

Groundwater Treatment System Operations
In October 2005 the IGWTS was taken off-line for the long-term. The GWTS continues to discharge treated water meeting discharge requirements. Other than shut down of the GWTS from about September 2007 through August 2008 for the rebound study and non-operation from about September 2008 until about August 2009 due to lack of contract as discussed above, the treatment component of the system had no significant upsets in the past five years.

The groundwater pumping rates have changed moderately over the past five years. Table 3 below provides a comparison between extraction well flow rates in Fourth Quarter 2004 and two months in 2010.

Table 3: Extraction Well Flow Comparison

Well ID	Flow (gpm) 4th Q 2004	Flow (gpm) March 2010	Flow (gpm) Dec. 2010	Comment
EW 113A'	12.9	14.1	18.4	
EW 113B	44.2	14.1	11.8	
EW 114B	18.0	26.0	0	Right of entry denied
EW 114C	0	24.5	0	Right of entry denied
EW 104B	23.0	19.4	0	Right of entry denied
EW 109B	31.9	0	0	Shut down since last FYR due to concentrations below MCLs
EW 72B	23.2	13.5	13.1	
EW 52C	0	0	10.0	Operates 8 hr/day at this rate
EW 54B	19.6	21.7	21.1	
EW 63A'	7.2	13.5	11.0	
TOTAL	180	146.8	85.4	

Changes in flow are generally made as a result of the Ahtna's ongoing modeling and optimization efforts. Extraction at wells EW114C and EW52C was initiated after the previous Five-Year Review. Extraction at well EW109B was halted since the last review as a result of continued concentrations of the COCs below their respective MCLs.

Regaining access to wells EW114B, EW114C, EW104B, and MW104C will be important in order to optimize extraction in this area. Well EW104B has had only one detection of chromium above 50 µg/L (June 2001), though concentrations have been consistently above 40 µg/L since November 2006. Concentrations of chromium have been above 50 µg/L in well MW104C since May 2007. There has been no extraction from this well, and no access for monitoring since March 2010. Well EW114B has had only one detection above 50 µg/L since August 1997 (70 µg/L in Aug 2009). Well EW114C has had no detections of chromium above 50 µg/L since August 1999.

Table 4 below provides annual average removal rates for chromium and cyanide during the years 2005 through 2010. These values were calculated from monthly removal rate information provided in Table 5 of Ahtna's Monthly Activity Summary Reports. There is a two-year period of no removal rate data due to the one-year rebound test and a lapse in the O&M contract, discussed above. In general, the mass removal rate of chromium has been declining in the past six years, although, as noted above, current extraction rates are approximately half those of six years ago. The cyanide removal rate has varied without a consistent trend.

Table 4: Annual Mass Removal Rates		
Year /months	**Chromium (lb/yr)**	**Cyanide (lb/yr)**
2005	2.06	0.38
2006	1.44	0.84
2007 (1st 8 months)	1.34	0.93
2009 (last 5 months)	0.29	0.24
2010	0.45	0.60

Groundwater Monitoring

Summary statistics of the quarterly groundwater monitoring data were developed from a subset of the monitoring well network and are presented in Tables 5 and 6 below. The wells selected include all the extraction wells and several monitoring wells at the west (downgradient) end of the plume. The time period evaluated includes all quarters from 2006 through 2010 as well as the first quarter of 2011. Attachment 9 provides the complete data set from that time period for all wells sampled in the monitoring program. In Tables 5 and 6 some trends are noted based on qualitative review of limited data.

Table 5: Groundwater Monitoring Summary Statistics for Chromium					
Well ID	**Number of Samples**			**Concentration Range (µg/L)**	**Comment**
	Collected	**Detections**	**Above MCL**		
52C	7	3	2	11-66	Extraction well.
54B	17	15	11	13-130	Strong effect (decrease) of in-situ treatability test. Rebound to pre-test condition apparent.
63A'	10	1	0	50	Single detect perhaps anomalous.
72B	9	2	0	5.2-5.4	2 detects, in 2006 & 2007.
104B	8	8	0	41-48	Consistently slightly under MCL; no data since 6/2010.
104C	8	8	7	45-82	Above MCL. Upward trend apparent over 5-years; no data since 3/2010.
109B	9	1	0	9.4	No detections near MCL.
112B	7	1	0	5.4	No detections near MCL.
112C	7	4	0	5.9-10	No detections near MCL.
113A'	11	9	1	10-62	All detections are 16 or less except one at 62.
113B	10	4	0	12-14	All detects in 2006 & 2007.
114B	3	3	1	16-70	Highest value is the most recent, and above MCL. Potential for upward trend.
114C	7	4	0	5-24	No detections above MCL; no data since 5/2010.

Table 6: Groundwater Monitoring Summary Statistics for Cyanide					
Well ID	**Number of Samples**			**Concentration Range (µg/L)**	**Comment**
	Collected	**Detections**	**Above MCL**		
52C	4	1	0	16	No detections near MCL.
54B	7	0	0	0	No detections.
63A’	17	17	15	148-940	Extraction well regularly above MCL.
72B	9	9	0	18-96	Consistent detections help define CN plume. Consider trend analysis.
104B	6	2	0	10-76	Detections in 2006, 2007.
104C	7	6	0	6.7-21	No detections near MCL.
109B	15	14	0	43-160	Consistent detections help define CN plume. Consider trend analysis.
112B	6	0	0	0	No detections.
112C	5	1	0	5.2	No detections near MCL.
113A’	11	11	0	22-94	Consistent detections help define CN plume. Possible upward trend. Consider trend analysis.
113B	10	8	0	10-43	Consistent detections help define CN plume. Consider trend analysis.
114B	1	0	0	0	No detections.
114C	6	0	0	0	No detections.

There has been a considerable loss of A/A’ zone wells from the monitoring program due to the long term decline of the water table. This loss of wells is particularly critical in the area directly down-gradient of the IWTP, where there are no A’ wells directly down-gradient of the IWTP until the off-site side of Claus Road. Replacement wells in the A’ zone in this area would confirm whether chromium concentrations above cleanup level still exist in this area.

The monitoring program has been optimized by establishing a sampling frequency of annual, semi-annual, or quarterly for each well, depending on data needs. The sampling frequencies should be re-evaluated periodically to maintain optimum cost-effectiveness and data quality. Wells with an established trend (e.g. EW54B, MW65A’, MW109B) could be monitored semi-annually at seasonally high and low groundwater elevations. Quarterly monitoring is most useful at locations where the short term effects of extraction flow changes or in-situ geochemical fixation must be evaluated. Long term data may also suggest a need for increased monitoring frequency at some wells, such as extraction well EW114B which has shown a possibly increasing concentration trend, with the latest result for chromium greater than the MCL.

Trend Analysis

The review team recommends that statistical trend analysis be performed periodically to provide the most supportable interpretation of trends and remediation progress. As part of this Five-Year Review, statistical analysis of concentration versus time trends for six wells was performed. The trends in groundwater concentrations were evaluated with Minitab statistical software using data from four monitoring wells for chromium: MW65A', MW54B, MW118B, and MW104C, and two wells for cyanide: EW63A', and EW71A'. These wells were selected as a subset of the overall monitoring network of RBAAP wells, predominately along the groundwater plume boundary. Details of the analysis and results from the computer program are provided in Attachment 7.

The methods used were linear regression, Mann-Kendall, and Sen's Slope. In addition, qualitative review of concentration versus time charts was performed. The entire data set available for each well was used, which in most cases included data from 1996 through March 2011. A summary of the analysis is provided below and in Table 7.

Table 7: Statistical Trend Analysis Summary

Well ID	M-K Trend	Sen's Slope μg/L-yr	2010 Avg. conc. (μg/L)
MW54B	Down	-21.4	73 (Cr)
MW118B	Up	13.5	110 (Cr)
MW65A'	Up	1.4	65 (Cr)
MW104C	None	0	81 (Cr)*
EW63A'	Up	15.8	290 (CN)
EW71A'	Down	-12.6	186 (CN)

*Average of 2009 data. Well inaccessible in 2010.

The Minitab analysis showed that wells with a statistical upward trend were monitoring wells MW65A' and MW118B for chromium, and extraction well EW63A' for cyanide. Wells with a statistical downward trend were monitoring well MW54B for chromium and extraction well EW71A' for cyanide. Well MW104C exhibited a distinct multi-year cycle in chromium concentration, generally increasing from 1996 to 2000, decreasing from 2000-2006, then increasing again from 2006 through 2009, although no trend was evident. Wells MW65A', EW63A', and MW104C all show two time periods with several results elevated above most other results.

It may be important to perform trend analysis over a shorter time interval as well as over the entire data set in order to represent the most current trend status for some wells. Several of the time versus concentration plots show patterns that suggest that natural events such as higher precipitation years might have an effect on concentrations. Changes in extraction well flows also affect the concentration trends.

Short term and long term trend analyses may provide differing interpretations of the success of remediation at those locations. Review of the long term trends considering effects of extraction well flow changes and precipitation conditions may provide insight as to whether the long term trend or the shorter current trend best represents the likely behavior at a well into the future.

The long and short term trends in MW104C identify that portion of the chromium plume as an area of concern. While the statistical analysis of the data from 1996 to present suggests no long term trend, data from the past five years suggests an upward trend. This well is at the furthest location downgradient of the source areas. Additional wells in this area are necessary to bound the plume and to better understand the trend of chromium concentrations in the future.

6.4.5 Landfill Data

There are 12 existing groundwater monitoring wells associated with the landfill. Of these, MW65A' has consistently been the only one in which chromium has been detected above the cleanup standard (Ahtna, 2011). Analysis showed MW65A' to have a statistical upward trend. Details of the analysis and results from the computer program are provided in Attachment 7.

The time versus concentration plot for MW-65A' in Attachment 7 shows a highly variable distribution of detections which differs from most other wells on site. There are several detections of chromium above the MCL. The Mann-Kendall analysis indicates a statistically significant upward trend. The erratic distribution of the data and the low value of Sen's slope raise some uncertainty about the future persistence of this trend.

The fact that the trend is not downward is important because it suggests that the cap may not be fully meeting the objective of preventing leaching of contamination to groundwater. The erratic pattern of the time versus concentration data is consistent with the notion that varying rates of precipitation are continuing to move residual soil contamination to the groundwater. The direction of infiltration of surface water around the periphery of the cap has a lateral component as well as a downward component, likely resulting in infiltration through contaminated soils at deeper horizons beneath the cap. The review team found no evidence that there were any failures of integrity of the cap.

Cyanide has not been detected above the cleanup standard in any of the landfill monitoring wells (Ahtna, 2011).

Surface water samples from the discharge pipe at the landfill are collected from at least two storm events that produce a continuous discharge during each wet season (October to May). No concerns are known to have been identified as a result of these samples.

Data from only one landfill monument survey, which was performed in 2008, was found. According to the 2008 Annual Landfill Inspection Report (AGSC, 2008), previous monument surveys were conducted by AGSC in July 2001 and June 2003, but they could not be located.

6.4.6 Recommended Changes to Monitoring Program

The following are recommended changes to the monitoring program:

Regain access to the extraction and monitoring wells west of the site as soon as possible, determine chromium concentrations in the monitoring wells and restart the extraction wells to contain the chromium plume until the in situ treatment design is implemented.

Install and monitor additional wells in the vicinity and downgradient of wells EW104 and EW 114 to better define contamination in this area.

Perform statistical trend analysis periodically to provide the most supportable interpretation of trends and remediation progress.

Review and update monitoring frequencies periodically to ensure data needs are met for all current concerns and to optimize costs.

7.0 Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

The aquifer zones in the RBAAP area are hydraulically interconnected; therefore, it is possible for contaminants to migrate from the upper zones (the A/A'- and B-zones) to the lower zones (the C- and D-zones). The rebound study provided evidence that the current GWTS has little impact on reducing chromium concentrations in localized areas of chromium contamination (AGSC, 2009). This indicates that the GWTS system may not be effective at reducing chromium concentrations to below the MCL in some areas. To reach the remediation goal of 50 µg/L for chromium defined in the ROD, a modified remedial approach has been recommended. The results of the in situ pilot test demonstrated that reductant injections rapidly reduced dissolved chromium concentrations by precipitating chromium. These results support the use of in situ treatment for the remaining areas of chromium contamination.

Results of the in situ pilot study indicated there was a sustained treatment for a minimum of six months, with a rapid reduction of dissolved chromium to below the MCL by the precipitation of low solubility trivalent chromium. Based on these results, in situ treatment has been recommended for the A'-, B-, and C-zones of the aquifer. In situ treatment in the A- zone is not planned as the A-zone is dry for the majority of the year and the proposed in situ treatment cannot be applied in such a case. However, if the A-zone recharges, in situ treatment may be applied to this aquifer zone. In situ treatment in the D-zone is deemed unnecessary because chromium has not been detected in the D-zone since 1999 (Ahtna, 2010). An Explanation of Significant Differences (ESD #1) has been developed to describe this treatment. Full-scale in situ treatment is in planning and has not been implemented.

Cyanide concentrations have been reduced from a maximum of 22,600 µg/L in 1993 to a maximum of 320 µg/L in the Second Quarter of 2010 with groundwater pump and treat operations (AGSC, 2006; Ahtna, 2010). The cyanide plume has also been significantly reduced in size by operation of groundwater pump and treat. The rebound study provided evidence that cyanide concentrations are greatly influenced by the pump and treat operations. The ROD-selected remedial action remains effective for cyanide, so this remedial action will continue to be used to treat groundwater contaminated with cyanide at concentrations above the MCL, and will continue to be used to contain chromium plumes until in situ treatment or other treatment options are implemented.

Based on analyses from MW65A', the landfill cap may have limited ability to prevent leaching of the chromium to groundwater. The pathway of surface water infiltrating through the soil has a lateral component as well as a vertical component that can result in leaching of contaminants in soils below the cap at depths below the waste material and closer to the groundwater. The erratic distribution of chromium concentrations at monitoring well MW65A', with several results above MCL, suggests this may be happening.

The site access controls are in place and have been successful in preventing unauthorized access to the landfill cap and GWTP areas. This has prevented any damage to the remedial systems that could be caused by unauthorized entry. The Army will implement deed restrictions at the landfill upon transfer, to ensure continued integrity of the landfill cover, since the RBAAP is closed under the BRAC 2005 recommendations.

Although no Property Management Plan was produced to analyze options for groundwater institutional controls and document the ICs for both the landfill and for groundwater, a Draft ESD #2 was produced as described in Section 5.3 above, which addresses the IC issues and is expected to be finalized in September 2011. The Army will implement deed restrictions on groundwater use. When the deed is in place it will protect against the future use of contaminated groundwater while the groundwater is undergoing remediation.

Opportunities for Optimization:

Results of the 2006 supplemental investigation (SOTA/CH2M Hill, 2006) and the longer term trend at EW-63A' suggest that there are sources further upgradient that are not directly treated and will continue to contribute to elevated cyanide concentrations. Additional source treatment may be worthwhile to accelerate cleanup of the cyanide plume. Results of rebound testing show that extraction well EW63A' is in a good location to capture cyanide contamination.

In-situ treatment of groundwater and deep soil below the landfill should also be considered for potential to accelerate progress toward the cleanup goal in this area.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Changes in Standards to Be Considered: The California State drinking water standard maximum contaminant level (MCL) for chromium of 50 µg/L identified as the groundwater remediation goal in the ROD has not changed since the ROD was signed. Further, the federal MCL is 100 µg/L. However, both the federal and state MCLs are based on total chromium, and the site groundwater contaminant is primarily hexavalent chromium (Cr 6+). USEPA has evaluated the health effects of chromium and is currently revising the toxicity factor for hexavalent chromium (http://cfpub.epa.gov/ncea/iris_drafts/recordisplay.cfm?deid=221433).

California has recently (July 27, 2011) adopted a public health goal (PHG) for Cr 6+ of 0.02 µg/L (http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Chromium6.aspx). This PHG was proposed in 2010. Now that the PHG is finalized, California will develop a revised MCL. Once a new MCL is in place, the treatment systems should be evaluated to determine if the selected remedy is viable.

Subsequent to the ROD, the California State drinking water standard MCL for cyanide has been lowered from 200 µg/L to 150 µg/L. The State MCL was lowered in 2003, and this change in ARARs was discussed in the Second Five-Year Review Report (AGSC, November 2006). That report concluded that the new MCL for cyanide is based on the same toxicity data and risk evaluations as the federal MCL of 200 µg/L, but the federal MCL is merely rounded up from 150 to 200 µg/L. The exposure assumptions, toxicity data, and remedial action objectives used at the time of the remedy selection are still valid, and the underlying risk information has not changed, so the current remedy is still protective of human health and the environment. Therefore, the cleanup level will remain "frozen" to the value stated in the ROD (i.e., 200 µg/L), in accordance with EPA policy.

Changes in Exposure Pathways: There are currently no complete exposure pathways for contaminated media at RBAAP. No changes in conditions at the RBAAP facility that affect exposure pathways were identified as part of this five-year review. Portions of the facility have been leased for use by private companies that use RBAAP facilities for industrial purposes. There are no current or planned changes in land use, and there are no new contaminant sources or routes of exposure associated with contaminants of concern in the ROD.

Changes in Toxicity, Other Contaminant Characteristics, and Risk Assessment Methodologies: The primary pathways evaluated in the risk assessment were related to exposure to contaminants in soil at the landfill and exposure to contaminated groundwater. The landfill cover eliminates potential exposure to soil contaminants, and no wells are producing water from the contaminated areas. Because there are no complete exposure pathways, a re-assessment of toxicity, contaminant characteristics, or risk assessment methodologies was not deemed necessary during this five-year review.

An evaluation of the ecological risk was previously performed by Ned Black, PhD, Regional CERCLA Ecologist/Microbiologist with US EPA. Cory Koger, PhD, Toxicologist with USACE reviewed the EPA Eco Risk Evaluation and found it to still be applicable. The ecorisk assessment concluded that "the original evaluation of ecological risk at this site remains valid. Therefore, the remedy under five-year review for this site is adequately protective of the environment." Details of this evaluation are provided in Attachment 5.

Expected Progress Toward Meeting RAOs: The groundwater remedy has progressed significantly and has achieved cleanup levels at many monitoring locations. Decreasing concentrations have reduced the recovery rates and efficiency of the system, such that continued reductions in concentrations will generally be slow, particularly for chromium. For this reason, ESD #1 was produced, as described in Section 5.2 above.

The effectiveness of the landfill is regularly evaluated using groundwater monitoring, surface water monitoring, final cover monitoring, and surface water drainage monitoring. Based on the erratic monitoring results in MW65A', additional evaluation in this area is warranted.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

New information that has come to light includes: monitoring and treatment of the groundwater at EW104B, EW114B, EW114C, and MW104C has not been conducted recently, with the last monitoring event in March 2010 and extraction wells shut down in May and June 2010. Therefore, the western extent of the chromium plume and concentration in this area has not been monitored in over a year and is not well-defined. Access to these wells was recently regained.

Technical Assessment Summary

Based on the document review, data analysis and review, site inspection, and interviews, the remedies appear to be functioning as intended by the ROD. However, additional evaluation is warranted, including the sources of chromium found upgradient of EW54B and near MW65A', and the extent of the chromium plume near EW104 and EW114. Except for non-operation of extraction wells EW104 and EW114, there have been no changes in the physical conditions at the RBAAP facility that would affect the protectiveness of the remedy. A new California State public health goal for hexavalent chromium was established on July 27, 2011. This PHG was proposed in 2010. Now that the PHG is finalized, California will develop a revised MCL. Once a new MCL is in place, the treatment systems should be evaluated to determine if the selected remedy is viable.

Institutional controls for groundwater are being addressed in the deed and are described in ESD #2, which is under development. Institutional controls are needed until the groundwater remediation process is completed to ensure that no unacceptable exposure to contaminated groundwater occurs. Also, deed restrictions at the landfill cap area are needed in order for the remedy to remain protective in the long-term. Institutional controls identified in the 1994 ROD are also being implemented for the landfill as deed restrictions. The Army is identifying and implementing options for groundwater institutional controls in the deed and is documenting the ICs for both the landfill and for groundwater in the forthcoming ESD #2.

8.0 Issues and Recommendations

Issues identified during the review, as well as recommendations and follow-up actions necessary to address the identified issues, are discussed below.

8.1 Land Use and Groundwater Use Controls

Issue: Land use controls, including groundwater use restrictions for the impacted aquifer and landfill use restrictions, have not been fully implemented as called for in the second Five-Year Review.

Recommendations: Complete implementation of deed restrictions on groundwater use and landfill disturbance to maintain long-term protectiveness of human health and the environment. Record land use controls in the deed as well as through a State Land Use Covenant (SLUC) as described in the FOST. The deed and SLUC should include the following land use restrictions: no use of groundwater, no residential use, and no disturbance of the landfill cap and wells. The SLUC should be prepared and signed by the DTSC, the RWQCB, and the RCLRA. The SLUC restrictions should be in effect until the deed provisions are terminated, removed, or modified as specified in an appropriate CERCLA decision document. The deed should include a provision reserving the Army's right to conduct remediation activities if necessary in the future. Also, coordinate communications between the Regional Water Quality Control Board and Stanislaus County to create a special groundwater protection zone, to address institutional controls off-site.

Although there are currently no institutional controls in place to ensure that no inappropriate use of contaminated groundwater or of the landfill occurs while the groundwater remediation is occurring, a Draft Final Explanation of Significant Differences (ESD #2) was prepared in April 2011 to address institutional controls regarding contaminated groundwater at the RBAAP that were developed and implemented after the ROD was signed in 1994. This document has not yet been finalized. Institutional controls will be included in the deed.

8.2 Western Extent of Chromium Plume is not Well-Defined

Issue: The western extent of the chromium plume has not been characterized in over a year and is not well-defined.

Recommendations: Access to wells EW104B, EW114B, EW114C, and MW104C was recently regained, so defining the western extent of the chromium plume should be performed as quickly as possible. Monitor or install other wells in the vicinity and down gradient of these wells to better define the plume in this area, and update extraction well capture zone estimates. Perform statistical trend analysis periodically to provide the most supportable interpretation of trends and remediation progress.

8.3 Source of Contamination Upgradient of EW54B is not Defined

Issue: The source of chromium found upgradient of EW54B is not defined and may be within the production area as suggested in SOTA/CH2M Hill (2007). Further characterization may be necessary for source remediation as described in ESD#1.

Recommendations: Better-define source areas for chromium contamination in the area upgradient of EW54B through methods similar to those used in the 2006 supplemental investigation (SOTA/CH2M Hill, 2007).

8.4 Chromium Concentrations in Landfill Monitoring Well MW65A'

Issue: Data from MW65A' suggest that the landfill cap may not fully satisfy the long term objective of protecting groundwater from chromium leaching from soil below the landfill.

Recommendation: Further investigate the causes of the persistent occurrences of chromium contamination above the cleanup goal in groundwater at the landfill. Alternatives for source treatment of deep soils and groundwater at the landfill should be considered in order to accelerate cleanup.

8.5 Groundwater Level in the A/A'-Zone

Issue: Groundwater levels continue to fall, resulting in loss of many monitoring wells in the A/A'-zone.

Recommendations: Evaluate monitoring program to determine if existing active wells are sufficient to monitor remedy performance over the long term.

Table 8: Issues Identified During the Five-Year Review

Issue	Affects Current Protectiveness (Y/N)?	Affects Future Protectiveness (Y/N)?
1. Land use controls on groundwater and landfill use have not been fully implemented.	N	Y
2. Western extent of chromium plume is not well-defined.	N	Y
3. Source of chromium upgradient of EW54B is not defined.	N	Y
4. Landfill cap may not fully satisfy objective of protecting groundwater from chromium leaching.	N	Y
5. Loss of monitoring wells in the A/A'-zone due to falling groundwater levels.	N	Y

Table 9: Recommendations and Follow-up			
Issue	**Recommendation**	**Responsible Entity**	**Milestone**
1. Land use controls on groundwater and landfill use have not been fully implemented.	Complete activities described in the draft final ESD#2 to formalize the ICs for the site.	Department of Army	
2. Western extent of chromium plume is not well-defined.	Access to applicable wells was recently regained, so chromium plume should be defined as quickly as possible. Monitor other wells in vicinity and down gradient of these wells to better define the plume in this area.	Department of Army	
3. Define Source Areas of Contamination Upgradient of EW54B.	Better-define source areas for chromium contamination in the area upgradient of the EW54B.	Department of Army	
4. Landfill cap may not fully satisfy objective of protecting groundwater from chromium leaching.	Further investigate the causes of the persistent occurrences of chromium contamination above the cleanup goal in groundwater MW65A' at the landfill.	Department of Army	
5. Loss of monitoring wells in the A/A'-zone due to falling groundwater levels.	Evaluate monitoring program to determine if existing active wells are sufficient to monitor remedy performance over the long term.	Department of Army	

9.0 Protectiveness Statement

The landfill remedial action is currently protective, based on continued O&M and groundwater monitoring results, although persistent occurrences of chromium contamination above the cleanup goal in groundwater at the landfill warrants further investigation.

The groundwater remedial action is operating as designed, with the exception of extraction wells EW104 and EW114, access to which has recently been regained, and is currently protective. In situ chromium reduction has been recommended by the contractor to achieve the chromium remediation goal more quickly.

Since both of the remedial actions are currently protective, the overall remedy at the RBAAP is protective of human health and the environment in the short term. The remedy has achieved reduction in size and extent of the chromium and cyanide plumes, and there has been no exposure to potential receptors. There has been no pumping of groundwater within the plume for beneficial use.

To ensure protectiveness in the long term, the Army must:

1. Formalize the institutional controls with deed restrictions that prevent inappropriate use of the landfill and prevent use of groundwater.

2. Monitor or install additional wells if necessary to determine the extent of the chromium plume downgradient of EW104 and EW114, particularly in the B and C monitoring zones.

3. Adjust groundwater treatment as necessary to address contamination at the downgradient edge of the chromium plume, particularly in the C-zone.

4. Further investigate potential source areas of chromium contamination, including upgradient of EW54B and near MW65A' at the landfill.

10.0 Next Review

This review is a statutory site that requires ongoing five-year reviews. The next review will be completed within five years of EPA's approval of this five-year review report.

Figures

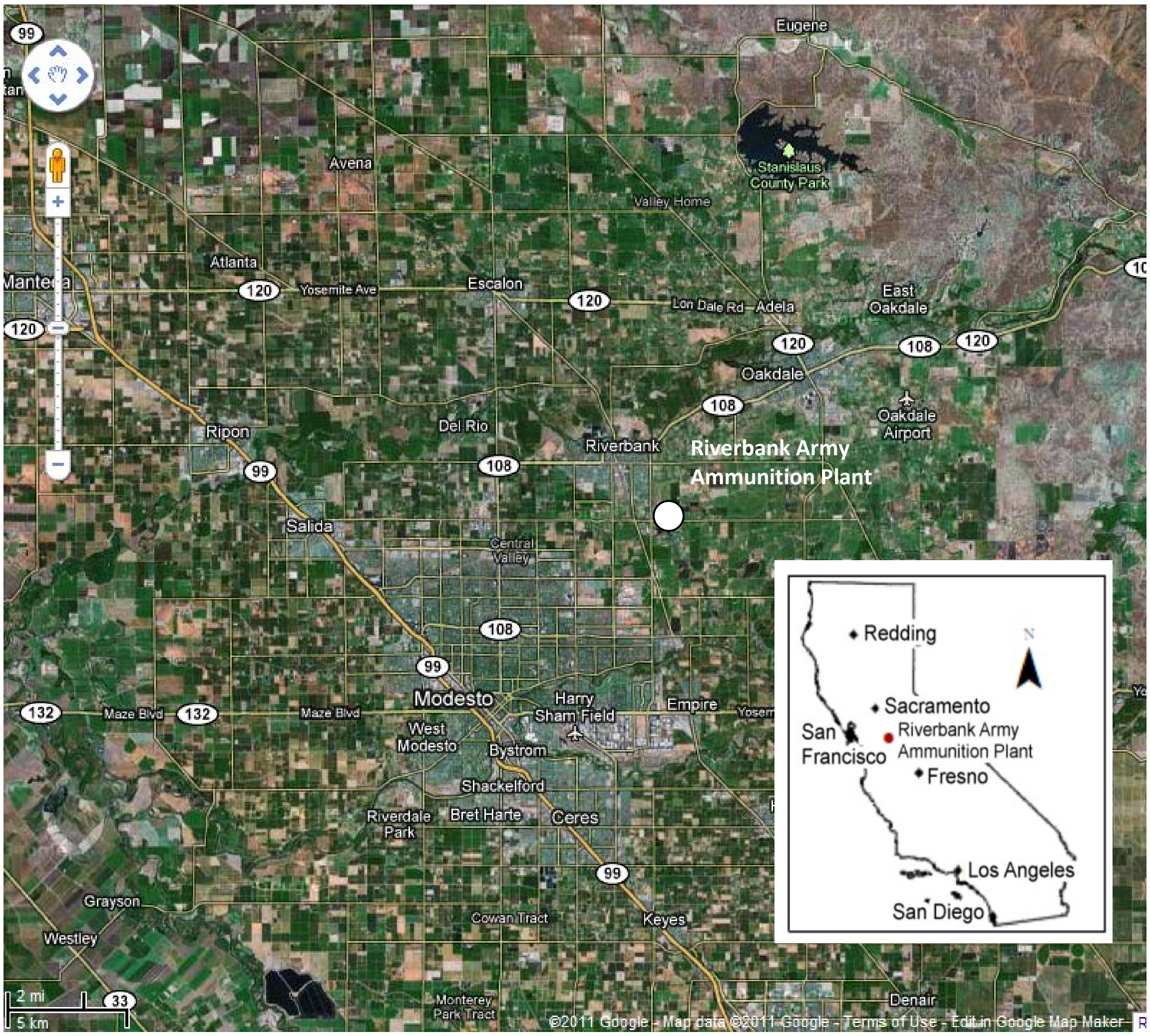

Figure 1: Riverbank Army Ammunition Plant Location Map. (Satellite image from Google Maps.)

Figure 2: On the left, Riverbank Army Ammunition Plant (RBAAP) Site Map. On the right, Evaporation Ponds located north of the RBAAP. (Satellite Images from Google Maps.)

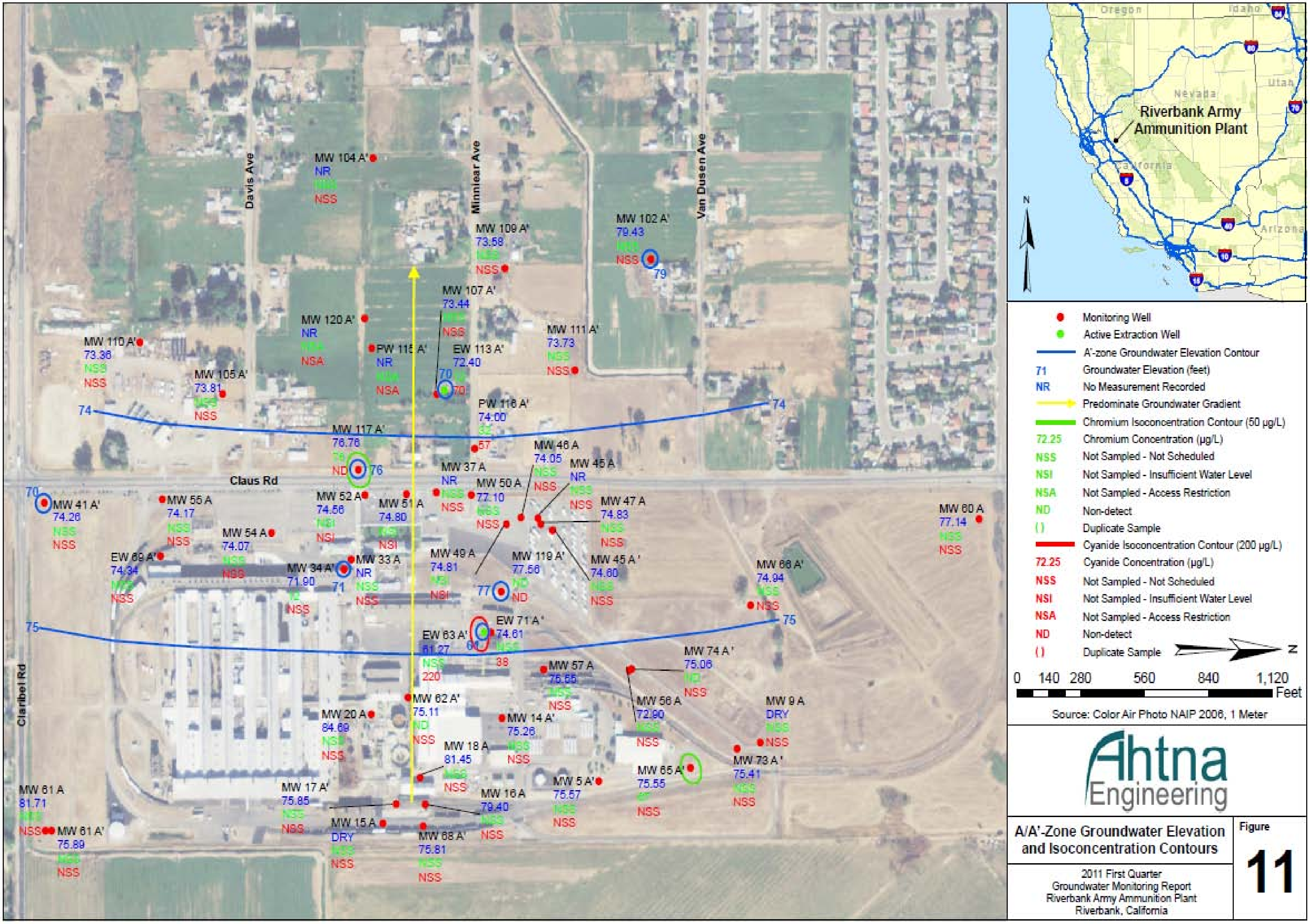

Figure 3: A/A'-Zone groundwater elevations and isoconcentration contours for the first quarter 2011 monitoring event. (Provided by Ahtna Engineering.)

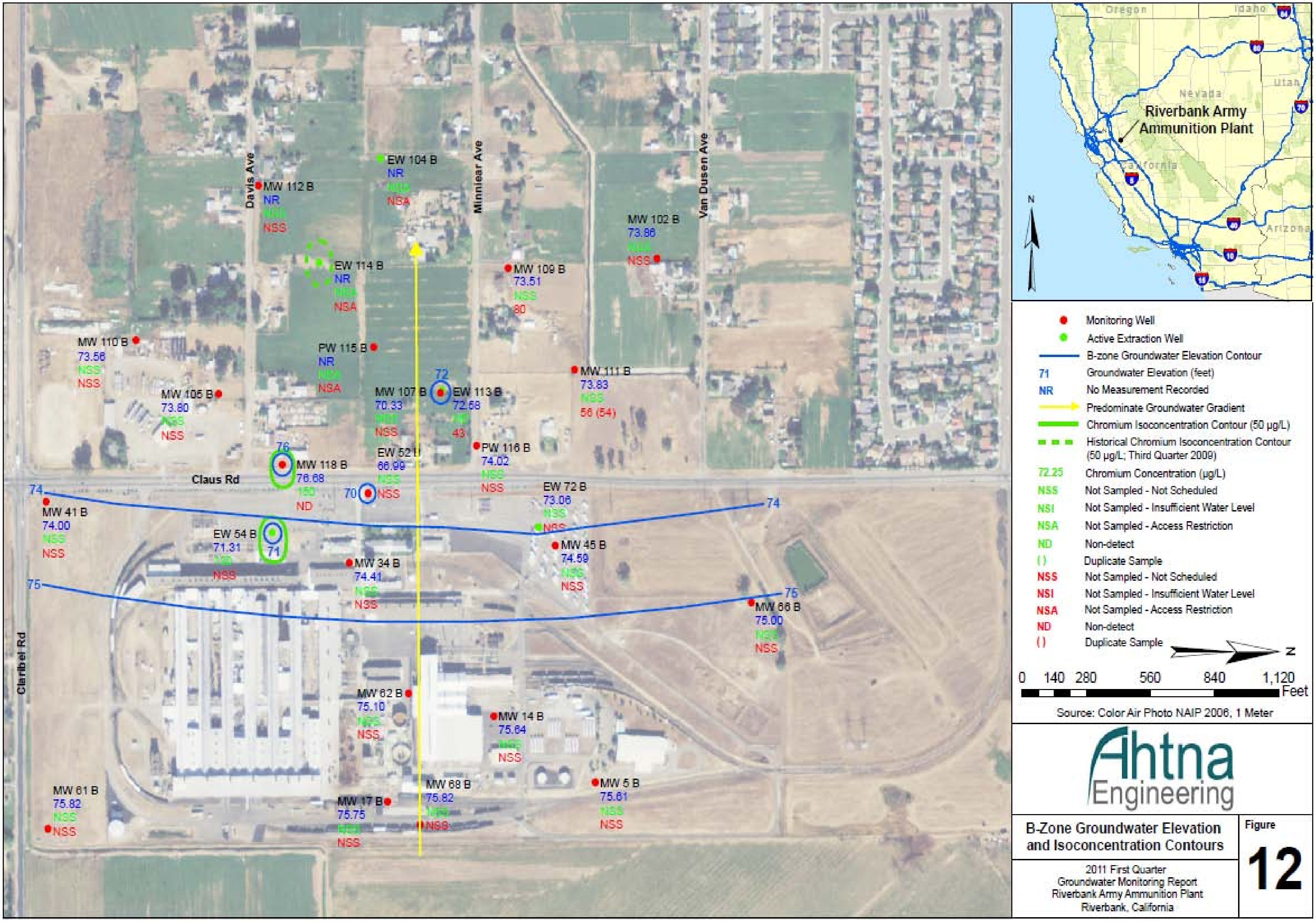

Figure 4: B-Zone groundwater elevations and isoconcentration contours for the first quarter 2011 monitoring event. (Provided by Ahtna Engineering.)

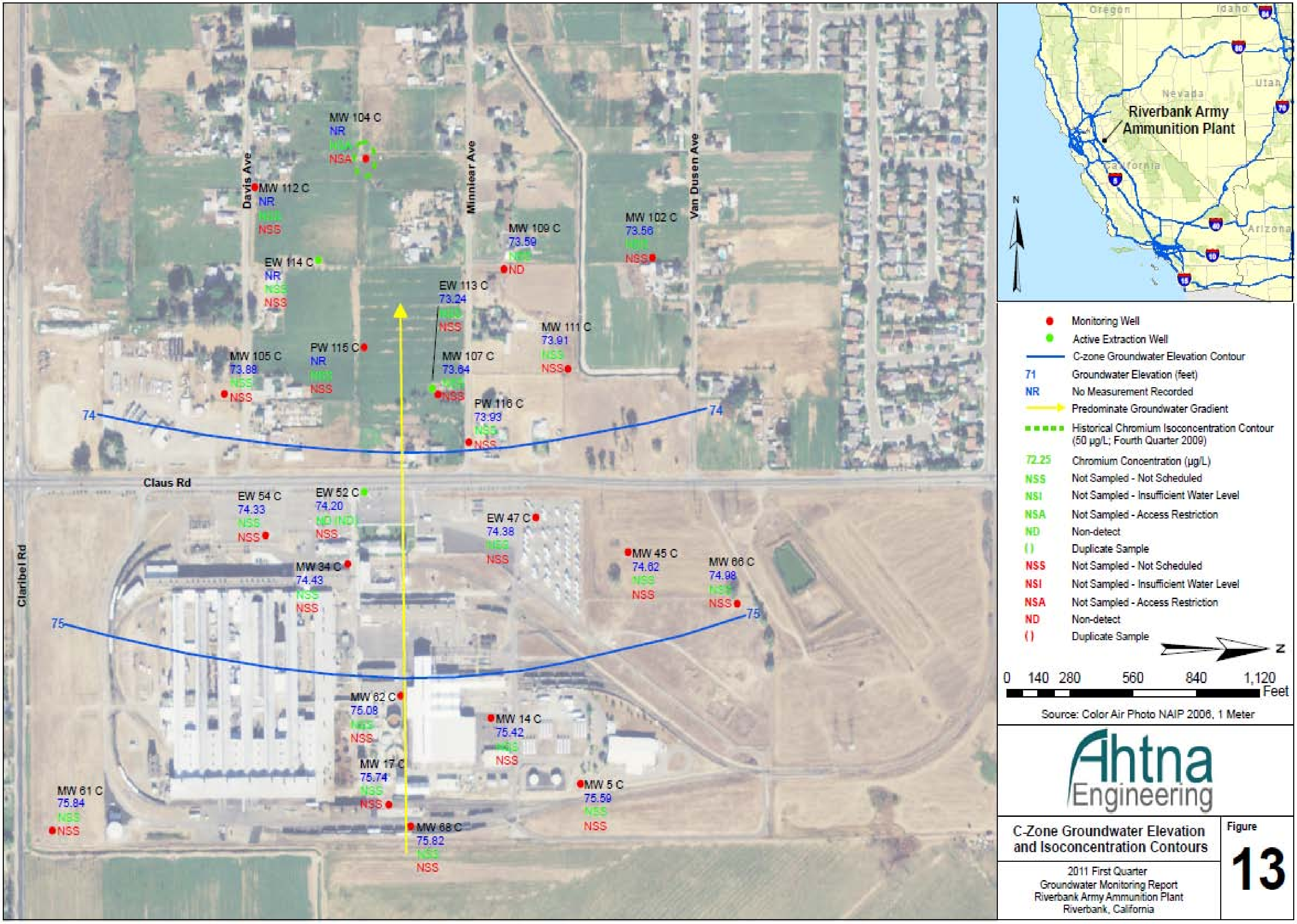

Figure 5: C-Zone groundwater elevations and isoconcentration contours for the first quarter 2011 monitoring event. (Provided by Ahtna Engineering.)

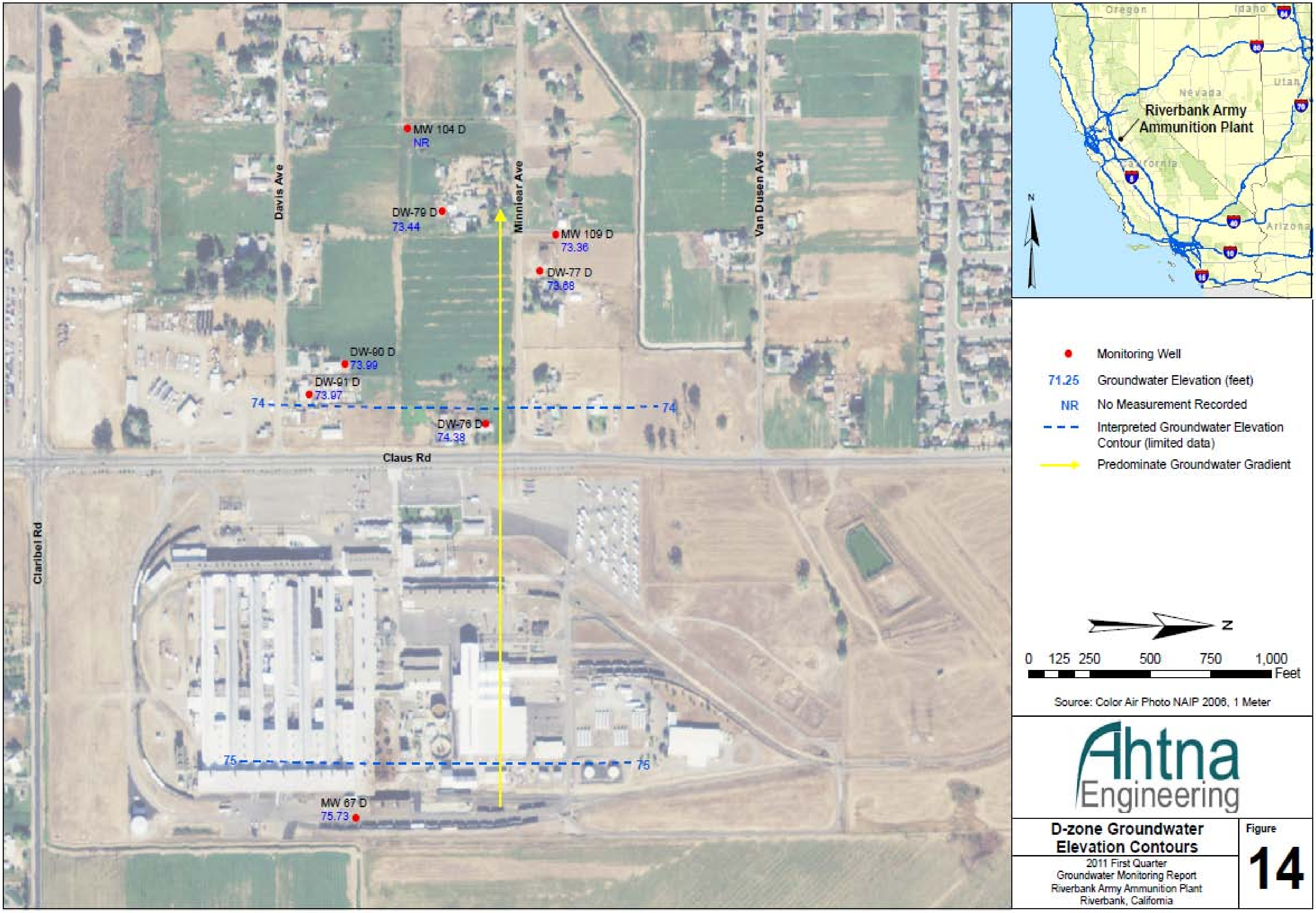

Figure 6: D-Zone groundwater elevations and isoconcentration contours for the first quarter 2011 monitoring event. (Provided by Ahtna Engineering.)

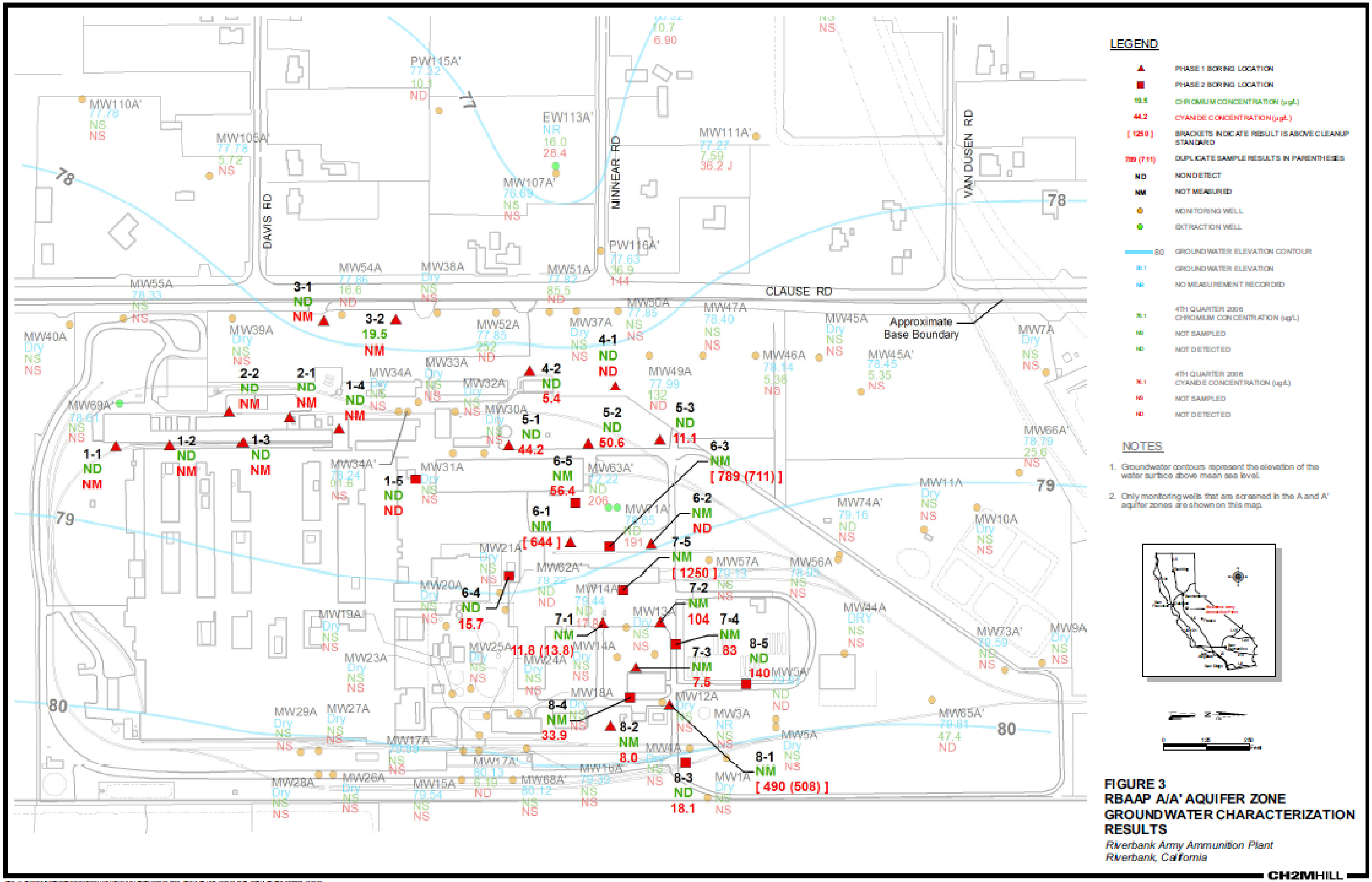

Figure 7: 2006 A/A' Aquifer Zone Supplemental Groundwater Characterization Results. (From SOTA/CH2M Hill, 2007.)

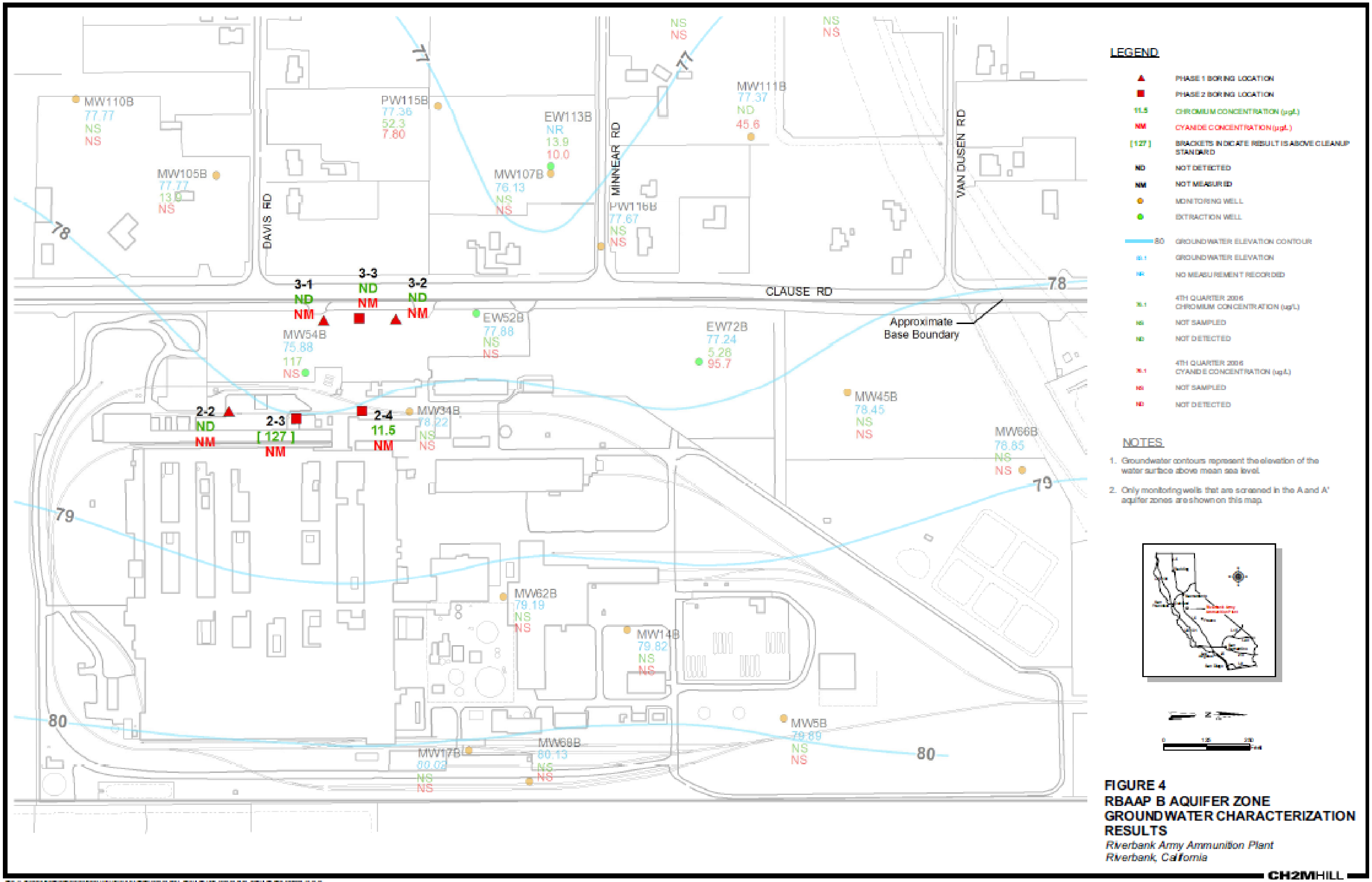

Figure 8: 2006 B Aquifer Zone Supplemental Groundwater Characterization Results. (From SOTA/CH2M Hill, 2007.)

Attachment 1

Site Inspection Checklist

Attachment 1

Site Inspection Checklist

I. SITE INFORMATION	
Site name: Riverbank Army Ammunition Plant (RBAAP)	**Date of inspection:** May 11, 2011
Location and Region: Riverbank, CA – Region 9	**EPA ID:** CA7210020759
Agency, office, or company leading the five-year review: U.S. Army	**Weather/temperature:** Sunny with a slight breeze, temperatures around 70°F
Remedy Includes: (Check all that apply) ☒ Landfill cover/containment ☒ Access controls ☒ Institutional controls ☒ Groundwater pump and treatment ☐ Surface water collection and treatment ☐ Other____ ☐ Monitored natural attenuation ☒ Groundwater containment ☐ Vertical barrier walls	
Attachments: ☐ Inspection team roster attached ☐ Site map attached	
II. INTERVIEWS (Check all that apply)	
1. **O&M site manager** Rachel Kerr (Name), Environmental Scientist (Title), May 11, 2011 (Date) Interviewed ☒ at site ☐ at office ☐ by phone Phone no. ______________ Problems, suggestions; ☒ Report attached ________________________________	
2. **O&M staff** Joseph Valenzuela (Name), Plant Operator (Title), May 11, 2011 (Date) Interviewed ☒ at site ☐ at office ☐ by phone Phone no. ______________ Problems, suggestions; ☒ Report attached ________________________________	

3.	**Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply. Agency Stanislaus County Contact Nicole Damin — Environmental Resources — May 25, 2011 — (209) 525-6725 Name — Title — Date — Phone no. Problems; suggestions; ☒ Report attached Agency USEPA Contact Lewis Mitani — Remedial Project Manager — May 11, 2011 Name — Title — Date — Phone no. Problems; suggestions; ☒ Report attached : No problems reported for the site. Everything seems to be in good condition. Agency Contact Name — Title — Date — Phone no. Problems; suggestions; ☐ Report attached Agency Contact Name — Title — Date — Phone no. Problems; suggestions; ☐ Report attached
4.	**Other interviews** (optional) ☒ Reports attached.

Clark Hunt, Safety Specialist for the Department of Army on the RBAAP site. No problems reported on the groundwater treatment or landfill maintenance.
Robert Smith, Department of Army Base Environmental Coordinator for RBAAP site. Reports that the contractor is doing a good job to clean up the site.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

☒ O&M manual	☒ Readily available	☐ Up to date	☐ N/A
☒ As-built drawings	☒ Readily available	☐ Up to date	☐ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☐ N/A

Remarks____

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A

☒ Contingency plan/emergency response plan ☒ Readily available ☐ Up to date ☐ N/A

Remarks____

3. **O&M and OSHA Training Records** ☒ Readily available ☐ Up to date ☐ N/A

Remarks____

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☐ N/A
☒ Effluent discharge	☒ Readily available	☒ Up to date	☐ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☐ N/A
☐ Other permits____________________	☐ Readily available	☐ Up to date	☐ N/A

Remarks____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks____

6. **Settlement Monument Records** ☒ Readily available ☐ Up to date ☐ N/A

Remarks__Only one (most recent - 2006) monument survey available.__________

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A

Remarks____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks____

9. **Discharge Compliance Records**

☐ Air	☐ Readily available	☐ Up to date	☒ N/A
☒ Water (effluent)	☒ Readily available	☒ Up to date	☐ N/A

Remarks____

10. **Daily Access/Security Logs** ☒ Readily available ☒ Up to date ☐ N/A

Remarks___Facility has access gate with security guard________________

IV. O&M COSTS

1. **O&M Organization**
- ☐ State in-house
- ☐ PRP in-house
- ☐ Federal Facility in-house
- ☐ Other__________________________________
- ☐ Contractor for State
- ☐ Contractor for PRP
- ☒ Contractor for Federal Facility

2. **O&M Cost Records**
- ☒ Readily available
- ☐ Up to date
- ☒ Funding mechanism/agreement in place

Original O&M cost estimate ___$1.9 million/yr_______ ☐ Breakdown attached

Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
10/1/2010	9/30/2011	$1.0 million	☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: __________________________________

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks The entire facility is fenced in with one entrance point, which is guarded. Only authorized personnel are allowed to enter.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks Access controlled by security patrols. Landfill has barbed wire topped fence with warning signs approximately every 150’ feet. Signs are in need of some repair to make them more visible.

C. Institutional Controls (ICs)
1. **Implementation and enforcement** Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A Type of monitoring (*e.g.*, self-reporting, drive by) _Site security guard with drive by security patrols. _ Frequency ___Multiple times per day. Responsible party/agency ______________________ Contact ______________ ______________ ________ __________ Name Title Date Phone no. Reporting is up-to-date ☐ Yes ☐ No ☐ N/A Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A Violations have been reported ☐ Yes ☐ No ☒ N/A Other problems or suggestions: ☐ Report attached Deed restrictions have not been implemented. As required in the ROD, deed restrictions will be required for the landfill if the Army closes the RBAAP facility. The ESD # 2, describing ICs will be finalized this year, 2011.
2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A Remarks______________________
D. General
1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident Remarks______________________
2. **Land use changes on site** ☐ N/A Remarks__Space has been leased to private companies, but land use has not changed.______________
3. **Land use changes off site** ☐ N/A Remarks______________________
VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks______________________
B. Other Site Conditions

Remarks ____

____

____

____

____

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident
Areal extent_______________ Depth_____________
Remarks____
____

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident
Lengths_____________ Widths____________ Depths___________
Remarks____
____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
Areal extent_______________ Depth_____________
Remarks____
____

4. **Holes** ☐ Location shown on site map ☒ Holes not evident
Areal extent_______________ Depth_____________
Remarks_It was difficult to see if any holes were present due to grass cover, which was scheduled to be cut soon; no holes were evident.

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☒No signs of stress
☐ Trees/Shrubs (indicate size and locations on a diagram)
Remarks____
____

6. **Alternative Cover (armored rock, concrete, etc.)** ☒ N/A
Remarks____
____

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident
Areal extent_______________ Height_____________
Remarks____
____

8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_______________
☐ Ponding ☐ Location shown on site map Areal extent_______________
☐ Seeps ☐ Location shown on site map Areal extent_______________
☐ Soft subgrade ☐ Location shown on site map Areal extent_______________
Remarks____
____

9.	**Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent_______________ Remarks_______________
B. Benches	☐ Applicable ☒ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)
1.	**Flows Bypass Bench** ☐ Location shown on site map ☒ N/A or okay Remarks_______________
2.	**Bench Breached** ☐ Location shown on site map ☒ N/A or okay Remarks_______________
3.	**Bench Overtopped** ☐ Location shown on site map ☒ N/A or okay Remarks_______________
C. Letdown Channels	☐ Applicable ☒ N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)
1.	**Settlement** ☐ Location shown on site map ☒ No evidence of settlement Areal extent_______________ Depth_____________ Remarks_______________
2.	**Material Degradation** ☐ Location shown on site map ☒ No evidence of degradation Material type_______________ Areal extent_______________ Remarks_______________
3.	**Erosion** ☐ Location shown on site map ☒ No evidence of erosion Areal extent_______________ Depth_____________ Remarks_______________
4.	**Undercutting** ☐ Location shown on site map ☒ No evidence of undercutting Areal extent_______________ Depth_____________ Remarks_______________
5.	**Obstructions** Type______________________ ☒ No obstructions ☐ Location shown on site map Areal extent_______________ Size_____________ Remarks_______________
6.	**Excessive Vegetative Growth** Type_____________________ ☒ No evidence of excessive growth ☒ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_______________ Remarks__Grass was scheduled to be cut soon._______________

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks______________________________

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks______________________________

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks______________________________

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks______________________________

5. **Settlement Monuments** ☐ Located ☒ Routinely surveyed ☐ N/A
Remarks The settlement monuments were not located due to grass cover, which was scheduled to be cut soon; Ahtna confirmed that the monuments had been last surveyed on 6/20/2008.

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. **Gas Treatment Facilities**
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance
Remarks______________________________

2. **Gas Collection Wells, Manifolds and Piping**
☐ Good condition ☐ Needs Maintenance
Remarks______________________________

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
☐ Good condition ☐ Needs Maintenance ☒ N/A
Remarks______________________________

F. Cover Drainage Layer ☒ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☒ Functioning ☐ N/A
Remarks______________________________

2. **Outlet Rock Inspected** ☒ Functioning ☐ N/A
Remarks______________________________

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1.	**Siltation** Areal extent______________ Depth____________ ☒ N/A ☐ Siltation not evident Remarks____
2.	**Erosion** Areal extent______________ Depth____________ ☒ Erosion not evident Remarks____
3.	**Outlet Works** ☐ Functioning ☒ N/A Remarks____
4.	**Dam** ☐ Functioning ☒ N/A Remarks____
H. Retaining Walls	☐ Applicable ☒ N/A
1.	**Deformations** ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement____________ Vertical displacement_______________ Rotational displacement____________ Remarks____
2.	**Degradation** ☐ Location shown on site map ☐ Degradation not evident Remarks____
I. Perimeter Ditches/Off-Site Discharge	☒ Applicable ☐ N/A
1.	**Siltation** ☐ Location shown on site map ☒ Siltation not evident Areal extent______________ Depth____________ Remarks____
2.	**Vegetative Growth** ☐ Location shown on site map ☐ N/A ☒ Vegetation does not impede flow Areal extent______________ Type____________ Remarks Minor vegetative growth needs to be removed as part of routine maintenance.
3.	**Erosion** ☐ Location shown on site map ☒ Erosion not evident Areal extent______________ Depth____________ Remarks____
4.	**Discharge Structure** ☒ Functioning ☐ N/A Remarks____
VIII. VERTICAL BARRIER WALLS	☐ Applicable ☒ N/A
1.	**Settlement** ☐ Location shown on site map ☐ Settlement not evident Areal extent______________ Depth____________ Remarks____

2. **Performance Monitoring** Type of monitoring___________________________
☐ Performance not monitored
Frequency________________________________ ☐ Evidence of breaching
Head differential___________________________
Remarks____
____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☒ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks__Wells EW104B, EW114B, and EW114C are not in operation because landowner has denied right of entry.____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs Maintenance
Remarks____
____

3. **Spare Parts and Equipment**
☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks____
____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks____
____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks____
____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks____
____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☒ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters____
☐ Additive (*e.g.*, chelation agent, flocculent)____
☒ Others ion exchange beds, holding tanks, and associated piping
☒ Good condition ☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☒ Sampling/maintenance log displayed and up to date
☒ Equipment properly identified
☒ Quantity of groundwater treated annually_approximately 25 million gallons_________________
☐ Quantity of surface water treated annually________________________
Remarks____
____

2.	**Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A ☒ Good condition ☐ Needs Maintenance Remarks
3.	**Tanks, Vaults, Storage Vessels** ☐ N/A ☒ Good condition ☒ Proper secondary containment ☐ Needs Maintenance Remarks
4.	**Discharge Structure and Appurtenances** ☐ N/A ☒ Good condition ☐ Needs Maintenance Remarks
5.	**Treatment Building(s)** ☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair ☒ Chemicals and equipment properly stored Remarks
6.	**Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked ☐ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A Remarks Wells EW104B, MW104C, EW114B, and EW114C are not in operation because landowner has denied right of entry.
D. Monitoring Data	
1.	Monitoring Data ☒ Is routinely submitted on time ☒ Is of acceptable quality Remarks
2.	Monitoring data suggests: ☒ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining Remarks Most wells declining or steady, but upward trend in some monitoring wells, including MW65A’ and MW118B for chromium, and extraction well EW63A’ for cyanide.
E. Monitored Natural Attenuation	
1.	**Monitoring Wells** (natural attenuation remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs Maintenance ☒ N/A Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The landfill cover and groundwater extraction and treatment system all appear to be in good condition and operating as intended.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M Plan Update was produced in 2006. However, the O&M plan does not reflect current plant ownership and operation. Therefore, the O&M Plan should be updated to reflect the current owner and operator. This does not affect the long-term protectiveness of the remedy.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

None.

D.	Opportunities for Optimization
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Ahtna has considered the opportunity for optimization and is currently developing a Geochemical Fixation In Situ Treatment Work Plan to treat chromium in the groundwater. This is also discussed in the Explanation of Significant Differences No. 1 which provides a rationale for modifying the selected remedy identified in the RBAAP ROD for the treatment of chromium contaminated groundwater.

Attachment 2

Documents Reviewed

Attachment 2

Documents Reviewed

Ahtna Government Services Corporation (AGSC), 2006. Riverbank Army Ammunition Plant Five Year Review, Riverbank, California.

Ahtna Government Services Corporation (AGSC), 2006. Final Groundwater Treatment System Operation and Maintenance Plan Update, Riverbank Army Ammunition Plant, Riverbank, California, November 18.

Ahtna Government Services Corporation (AGSC), 2008. Riverbank Army Ammunition Plant Landfill Post-Closure 2008 Annual Report, Riverbank, California.

Ahtna Government Services Corporation (AGSC), 2009. Monthly Activity Summary Report, December 2008, Riverbank Army Ammunition Plant Groundwater Remediation, January 30.

Ahtna Government Services Corporation (AGSC), 2009. Fourth Quarter 2008 Groundwater Monitoring Report, Riverbank Army Ammunition Plant, Riverbank, California, January 30.

Ahtna Government Services Corporation (AGSC), 2009. Landfill Post-Closure Quarterly Report, Fourth Quarter 2008, Riverbank Army Ammunition Plant, Riverbank, California, January 30.

Ahtna Government Services Corporation (AGSC), 2009. Geochemical Fixation In Situ Pilot Test Draft Final Report, Riverbank Army Ammunition Plant, Riverbank, California, February 6.

Ahtna Government Services Corporation (AGSC), 2009. Rebound Study Report Draft Final, Riverbank Army Ammunition Plant, Riverbank, California, February 6.

Ahtna Engineering (Ahtna), 2009. Landfill Post-Closure Quarterly Report, Riverbank Army Ammunition Plant, Riverbank, California, Third Quarter – Fourth Quarter.

Ahtna Engineering (Ahtna), 2009. Monthly Activity Summary Report, Riverbank Army Ammunition Plant Groundwater Remediation, September-December.

Ahtna Engineering (Ahtna), 2009. Riverbank Army Ammunition Plant Well Abandonment, Riverbank, California, December 4.

Ahtna Engineering (Ahtna), 2010. Riverbank Army Ammunition Plant Groundwater Monitoring Program, Quarterly Groundwater Monitoring Report, 2009 Fourth Quarter Semiannual, Riverbank, California, January.

Ahtna Engineering (Ahtna), 2010. Landfill Post-Closure Quarterly Report, Riverbank Army Ammunition Plant, Riverbank, California, First Quarter – Fourth Quarter.

Ahtna Engineering (Ahtna), 2010. Monthly Activity Summary Report, Riverbank Army Ammunition Plant Groundwater Remediation, January-December.

Ahtna Engineering (Ahtna), 2010. Quarterly Groundwater Monitoring Report, Riverbank Army Ammunition Plant, Riverbank, California, First Quarter – Fourth Quarter.

Ahtna Engineering (Ahtna), 2011. Draft Geochemical Fixation In Situ Treatment Work Plan, Riverbank Army Ammunition Plant, Riverbank, California, March.

Ahtna Engineering (Ahtna), 2011. Monthly Activity Summary Report, Riverbank Army Ammunition Plant Groundwater Remediation, January-March.

Ahtna Engineering (Ahtna), 2011. Quarterly Groundwater Monitoring Report, Riverbank Army Ammunition Plant, Riverbank, California, First Quarter, April.

Ahtna Engineering (Ahtna), 2011. Landfill Post-Closure Quarterly Report, Riverbank Army Ammunition Plant, Riverbank, California, First Quarter, April.

CH2M Hill, 1996. Riverbank Army Ammunition Plant Groundwater Extraction System Design and Monitoring Plan with System Operating Procedures Document, Prepared for U.S. Army Corps of Engineers, August.

CH2M Hill, 1997. O&M Manual, Riverbank Army Ammunition Plant, Groundwater Treatment System (GWTS), September.

CH2M Hill, 1997. Final Extraction System Design and Monitoring Plan, Riverbank Army Ammunition Plant, September.

CH2M Hill, 2005. Final RCRA Facility Investigation Report, Riverbank Army Ammunition Plant, February.

CH2M Hill, 2006. U.S. Army BRAC 2005 CERFA Report, Riverbank Army Ammunition Plant, Riverbank, California, August 10.

City of Riverbank Local Redevelopment Authority (RCLRA), 2008. Meeting Agenda, November 30.

Davy International, 1995. Riverbank Army Ammunition Plant Landfill Closure, Project Work Plan, Prepared for U.S. Army Corps of Engineers, Delivery Order No. 0006, May.

U.S. Army Corps of Engineers, 1994. Landfill Closure Specifications (Bid Set Submittal), December 23.

U.S. Army Corps of Engineers, 1994. Landfill Closure Design Analysis Report (Bid Set Submittal), December 23.

U.S. Army Corps of Engineers, 2009. Environmental Assessment for BRAC 05 Disposal and Reuse of the Riverbank Army Ammunition Plant, California, March.

U.S. Department of the Army, 2010. Finding of Suitability to Transfer (FOST) Riverbank Army Ammunition Plant Parcels 1, 1a, 2, 2a, and B, April.

U.S. Department of the Army, 2011. Draft Finding of Suitability for Early Transfer (FOSET) Riverbank Army Ammunition Plant Remainder Parcel A, Northwest Stormwater Reservoir, and Evaporation/Percolation Ponds, April.

U.S. Department of the Army, 2011. Final Explanation of Significant Differences No. 1 to the Riverbank Army Ammunition Plant (RBAAP) Record of Decision, Riverbank, California, March.

U.S. Department of the Army, 2011. Draft Final Explanation of Significant Differences No. 2 to the Riverbank Army Ammunition Plant (RBAAP) Record of Decision, Riverbank, California, April.

U.S. Army Environmental Center, 1994. Record of Decision, Riverbank Army Ammunition Plant. March.

U.S. Army Riverbank Army Ammunition Plant, 2001. Five Year Review, Riverbank Army Ammunition Plant, Riverbank, California, February.

Roy F. Weston, Inc. (Weston), 1991. Riverbank Army Ammunition Plant Remedial Investigation Report, Volume I. West Chester, Pennsylvania. Prepared for Commander, U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Maryland, July.

Roy F. Weston, Inc. (Weston), 1991. Riverbank Army Ammunition Plant Remedial Investigation Report, Volume II – Appendices. West Chester, Pennsylvania. Prepared for Commander, U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Maryland, July.

Roy F. Weston, Inc. (Weston), 1991. Riverbank Army Ammunition Plant Final Remedial Investigation Report. West Chester, Pennsylvania. Prepared for U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland, May.

SOTA Environmental and CH2M Hill (SOTA/CH2M Hill), 2007. Groundwater Characterization for Optimizing Remediation Data Summary, Riverbank AAP. Technical Memorandum, March 15.

Attachment 3

Applicable or Relevant and Appropriate Requirements (ARARs)

ATTACHMENT 3

Applicable or Relevant and Appropriate Requirements (ARARs)

Actions	Requirements	Prerequisites	Citation for Federal Requirements	Citation for California Requirements
Construction of Groundwater Extraction and Monitoring Wells	The construction of all extraction and monitor wells must comply with California Well Standards construction requirements.	Construction of extraction and monitoring wells.	NA	California Well Standards, Bulletin Nos. 74-81 and 74-90 – Applicable
Groundwater Extraction	The groundwater will be extracted and treated until the aquifer meets federal and state MCLs and state Water Quality Objectives (WQOs) for protection of the beneficial use classifications for municipal, domestic, industrial, and agricultural water supply: • Chromium – 50 µg/L (CA MCL; CA WQO). • Cyanide – 200 µg/L (Safe Drinking Water Act (SDWA) MCL).	None	57 FR 31776 (17 July 1992, effective 17 January 1994), to be codified at SDWA 40 CFR, Part 141 – Relevant and appropriate 40 CFR 300.430(c)(2)(i)(B) – Applicable	Title 22, CCR Chapter 15, §§64401 et seq. – Applicable California RWQCB Title 23, CCR Chapter 23 §3000 (California Inland Surface Waters Plan - Basin Plan 5B) State Board Resolution 88-63 State Board Resolution 68-26 - Applicable Pursuant to ROD, substantive provisions of Article 5 contained in the sections of Chapter 15 listed below are to be followed - Title 23, CCR, Division 3, Chapter 15, §§2550.1, 2550.5 - 2550.10, and 2550.12.

Actions	Requirements	Prerequisites	Citation for Federal Requirements	Citation for California Requirements
Groundwater Treatment at the IGWTS and IWTP with Direct Discharge of Treatment System Effluent to the OID Canal	Must take action to protect affected fish or wildlife resources of the Stanislaus River – Applicable.	Point source discharge to waters of the United States – protection of downstream water – Stanislaus River	Fish and Wildlife Coordination Act (16 USC 661 et seq.); 40 CFR 6.302(g) – Applicable	Title 23, CCR Chapter 9, Article 3 (Substantive requirements with respect to discharge of chromium and cyanide to be followed by agreement as stated in the ROD.)
	National Pollutant Discharge Elimination System (NPDES) Permitting Program (with respect to chromium and cyanide).		40 CFR 122.44(a) (CWA) – Applicable	
	Use of best available technology economically achievable (BATEA) is required to control toxic and nonconventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis.			
	The discharge must comply with applicable federal Water Quality Criteria (WQC) and California WQOs for the protection of human health and aquatic organisms specified for the use classifications for the Stanislaus River. E/P Ponds: • Chromium (VI) less than 50 µg/L (monthly average) • Cyanide - 5.2 µg/L (monthly average) OID Canal: • Chromium (VI) - 11 pg/L (CA WQO for the protection of aquatic life - 4-day average concentration not to be exceeded more than once every 3 years ; 1-hour average 16 µg/L).		CWA Sections 303(c)(2)(B) and 304(a) – Relevant and appropriate	State Board Resolution 68-16
	The discharge must be consistent with the requirements of a Water Quality Management Plan approved by EPA under the Clean Water Act (CWA) §208(b).		40 CFR 122.44(d) – Applicable	
	Discharge limitations must be established for all toxic pollutants that are or may be discharged at levels greater than that which can be achieved by technology-based standards.		40 CFR 122.44(e) – Applicable	
	Develop and implement a best management practice (BMP) program and incorporate in the NPDES permit to prevent the release of toxic constituents to surface waters.		40 CFR 125.100 – Applicable	
	Criteria and standards for NPDES permit.		40 CFR 125 – Applicable	

Actions	Requirements	Prerequisites	Citation for Federal Requirements	Citation for California Requirements
Groundwater Treatment at the IGWTS and IWTP with Direct Discharge of Treatment System Effluent to the OID Canal (continued)	The BMP program must: • Establish specific procedures for the control of toxic and hazardous pollutant spills. • Include a prediction of direction, rate of flow, and total quantity of toxic pollutants where experience indicates a reasonable potential for equipment failure. • Ensure proper management of solid and hazardous waste in accordance with regulations promulgated under RCRA.	Discharge to waters of the United States	40 CFR 125.104 – Applicable	
	To ensure compliance, the discharge must be monitored for: • The volume of effluent. • The mass of each pollutant. • Frequency of discharge and other measurements, as appropriate.		40 CFR 122.44(i) – Applicable	
	Approved test methods must be followed for monitored waste constituents. Detailed requirements for analytical procedures and quality control (QC) are provided.		40 CFR 136.1 to 136.3(e) – Applicable	
	Comply with additional permit conditions such as: • Proper operations and maintenance (O&M) of treatment systems • Duty to mitigate any adverse effects of any discharge	Offsite dischargers	40 CFR 122.41(d,e) – Applicable	
Groundwater Treatment at the IGWTS and IWTP with Discharge to the E/P Ponds	The discharge must comply with applicable federal Water Quality Criteria (WQC) and California WQOs for the protection of human health and aquatic organisms specified for the use classifications for the Stanislaus River: E/P ponds: • Chromium (VI) less than 50 µg/L (monthly average) • Cyanide – 5.2 µg/L (monthly average) OID Canal: • Chromium (VI) – 11 pg/L (CA WQO for the protection of aquatic life - 4-day average concentration not to be exceeded more than once every 3 years ; 1-hour average 16 µg/L). • Cyanide – 5.2 µg/L (CA WQO for the protection of aquatic life – daily average; 1-hour average 22 µg/L)		CWA Sections 303(c)(2)(B) and 304(a) – Relevant and appropriate	State Board Resolution 68-16

Actions	Requirements	Prerequisites	Citation for Federal Requirements	Citation for California Requirements
Groundwater Treatment at the IGWTS and IWTP with Discharge to the E/P Ponds (continued)	Must take action to conserve threatened species; must not destroy or adversely modify the critical habitat of the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*); consultation with the Department of Interior (DOI).	Critical habitat upon which a federally threatened species depends	Endangered Species Act of 1973 (16 USC 1531 et seq.); 50 CFR 402; Fish and Wildlife Coordination Act (16 USC 661 et seq.); and.33 CFR 320.330 – Applicable	
Disposal of Treatment Residuals	Hazardous waste that is transported offsite for disposal must be received by a hazardous waste facility that has an appropriate and valid Hazardous Waste Facility Permit or that is otherwise authorized by the State Department of Health Services.	Off-site disposal of hazardous waste		Title 22, CCR Division 4.5, Chapter 13, §66263,23(b) – Applicable if the treatment residues are hazardous waste and they are disposed of offsite.
	Waste must be packaged and transported according to RCRA, U.S. Department of Transportation (DOT), and California Highway Patrol requirements.	Transportation of hazardous waste across public highway	40 CFR 262; 49 CFR 175, 178, and 179 – Applicable if the treatment residues are hazardous waste and they are disposed of offsite.	Title 22, CCR Division 4.5, Chapter 13, §66263.23(b) – Applicable if the treatment residues are hazardous waste and they are disposed of offsite.
Fugitive Dust Emissions During Excavation and Grading	Application of water, chemicals, or vegetation to control dust emissions.	Fugitive emissions from construction, demolition, excavation, land clearing, grading, land leveling, cut and fill operations, travel on the site, and travel on access roads to and from the site		Rule 8020; Rule 8040; and Rule 8060 – Applicable
	Prevent or expeditiously remove any visible accumulation of mud or dirt from public paved roads, including shoulders, adjacent to the site of the landfill.	Landfill disposal site		
Final Cover	Placement of a cover over waste. Pursuant to the Dispute Resolution Agreement reached during negotiations on 11 February 1993, the final cover of the landfill must include: • A foundation soil layer of sufficient stability provided by grading and compacting existing landfill soils.	Closure of any landfill		Substantive provisions of Articles 5 and 8 of Chapter 15 are to be followed as set out in the Dispute Resolution Agreement.

Actions	Requirements	Prerequisites	Citation for Federal Requirements	Citation for California Requirements
Final Cover (continued)	• A 1-ft-thick clay layer consisting primarily of clays from a clean source on the installation. The clay source will be supplemented, as necessary, by off-site clays to produce a clay layer with a design permeability of 1 x 10^{-6} cm/sec. • Geotechnical data collected from a source at the installation to determine the appropriate ratio of on-site to off-site clays to achieve a design permeability of 1 x 10^{-6} cm/sec. • A minimum of 1 ft of clean topsoil placed over the clay layer to provide an adequate rooting depth for vegetative cover and protection of the clay layer. • The final cover designed with the objective of minimizing maintenance. • The final cover graded to provide a minimum of 2% slope to minimize ponding of precipitation and provide adequate drainage. • The final cover constructed in accordance with an approved Construction Quality Assurance Plan (CQAP).			
Post-Closure Maintenance	Restrict post-closure use of property as necessary to prevent damage to the cover.	Find closure of a hazardous waste landfill with some hazardous materials or residues left in-place		Substantive provisions of Articles 5 and 8 of Chapter 15 are to be followed as set out in the Dispute Resolution Agreement.
	Post-closure maintenance shall extend as long as wastes pose a threat to water.	Post-closure maintenance requirements for landfills in California		Substantive provisions of Articles 5 and 8 of Chapter 15 are to be followed as set out in the Dispute Resolution Agreement.

Actions	Requirements	Prerequisites	Citation for Federal Requirements	Citation for California Requirements
Post-Closure Maintenance (continued)	Pursuant to the Dispute Resolution Agreement reached during negotiations on February 11, 1993, the following actions during post-closure maintenance must be taken: • The final cover will be maintained to ensure its integrity and effectiveness for a period of 20 years. • **A 5-year review process** under the RBAAP FFA will be used to evaluate whether continued maintenance of the cover is necessary to protect human health and the environment, including water quality **after the 20-year maintenance period** (see ROD). • One or two additional monitoring wells will be installed at the point of compliance to protect beneficial uses of the groundwater.			
Well Construction for Contained Groundwater Monitoring	The construction of all monitoring wells must comply with the California Well Standards construction requirements.	Construction of monitoring wells		California Well Standards, Bulletins 74-81 and 74-90 – Applicable

Attachment 4

Public Notice

Story #10284 System MODZ by GONZALEZ Time 14

Name US ARMY CORPS OF ENGINEERS Phone 9165576886
Address 1325 J ST. 12TH FL. Account 5576886US
Class 8000 Times 1 Start 5/15/11 Stop 5/15/11
Total Cost 185.78 Total Paid 185.78Rep GONZALEZ
Lines 23 AD COPY ENLARGED TO 150% > LIVEPAG

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Public Notices
Five-Year Review
Riverbank Army Ammunition Plant
Riverbank, California

The U.S. Army Corps of Engineers is conducting the third five-year review of environmental remedial actions implemented at Riverbank Army Ammunition Plant (RBAAP) in Riverbank, California. Since 1980, the Army has been conducting investigations of past plant operations at RBAAP under the Installation Restoration Program. Investigations led to RBAAP being placed on the National Priorities List (NPL) in February 1990 due to chromium and cyanide contamination found in the groundwater. In 1994, the Record of Decision (ROD) was signed by the USEPA, the DTSC, the Regional Water Board and the Army and included two response actions, one for the groundwater and the other for the landfill. The landfill remedy included installing a final cover, installing additional monitoring wells near the landfill, and maintaining it for 20 years. Construction of the landfill remedial action was completed in 1996. A groundwater extraction and treatment system was the preferred approach to treat the chromium and cyanide contamination associated with past operations that had contaminated groundwater both on and off the RBAAP facility. The systems for addressing contamination in the groundwater have been operational for the last 15 years.

This is the third five-year review conducted at the Riverbank Army Ammunition Plant. This five-year review will evaluate the effectiveness of the cleanup remedies and determine whether the remedies continue to be protective of human health and the environment. The review is required at sites where the selected remedy results in contaminants remaining on-site at levels that would not allow for unlimited use and unrestricted exposure. An upcoming public notice announcing completion of the five year review and the location of the final Five-Year Review Report is anticipated to be released in September 2011. If you have any questions or would like to provide comments, please contact Mr. Patrick Plumb of the U.S. Army Corps of Engineers at (916) 557-7249 or Mr. Robert Smith of the Riverbank Army Ammunition Plant at (209) 869-7274.

DECLARATION OF PUBLICATION
(C.C.P. S2015.5)

COUNTY OF STANISLAUS
STATE OF CALIFORNIA

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am a printer and principal clerk of the publisher of
THE MODESTO BEE,
which has been adjudged a newspaper of general circulation by the Superior Court of the County of **STANISLAUS,** State of California, under the date of **February 25, 1951, Action No. 46453.** The notice of which the annexed is a printed copy has been published in each issue thereof on the following dates, to wit:

MAY 15, 2011

I certify (or declare) under penalty of perjury that the foregoing is true and correct and that this declaration was executed at **MODESTO,** California on

MAY 15, 2011

Marie Dieckman

(Signature)

Public Notices
Five-Year Review
Riverbank Army Ammunition Plant
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Pub Dates: May 15, 2011
MOD 10284

Attachment 5

Evaluation of Ecological Risk

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 9
75 Hawthorne Street
San Francisco CA 94105-3901

Memorandum

DATE: 28 November 2005

FROM: Ned Black, Ph.D.
Regional CERCLA Ecologist/Microbiologist, SFD-8-4

TO: Xuan-Mai Tran, Remedial Project Manager, SFD-8-3
Cynthia Wetmore, Regional CERCLA Engineer, SFD-8-4

SUBJECT: Evaluation of ecological risk for the Five Year Review of Riverbank Army Ammunition Plant

The original evaluation of ecological risk at this site remains valid. Therefore, the remedy under five year review for this site is adequately protective of the environment.

The details of this evaluation are as follows.

Site name: Riverbank Army Ammunition Plant
EPA ID# CA7210020759 **Location:** 10mi northeast of Modesto, California
ROD date: 17 March 1994
5-year review date: 24 September 2006
Was there an ERA?
Yes. (summary in section 2 of ROD- rpt not found)
Were any ecological receptors evaluated?
Earthworms and plants.
Were sensitive habitats (per the NCP) evaluated?
Yes. There are evaporation/percolation (E/P) ponds in a riparian habitat and EPA asked the Army not to develop the surrounding area further. The same area may contain seasonal wetlands as well.
What contaminants are present at the surface?
cyanide, chromium, zinc, fluoride, thallium
Were complete exposure pathways considered?
No. Concentrations in soils were only compared to TRVs.
Is a Section 7 (ESA) consultation letter or documentation of informal Section 7 consultation on file?
No.
Can the statement that the remedy is "protective of the environment" be supported?
Yes.

List of eco-relevant documents (Itx #s):

9-30-1992	draft final feasibility study rpt	3135-00002
3-16-1994	Record of Decision (ROD)	3135-00032

List of other documents looked at (Itx #s):

4-30-1987	final rpt: remedial investigation of RBAAP	3135-00006
8-15-1996	5-year review rpt, RBAAP	3135-00096
2-20-2001	5-year review rpt	(Doc ID) 126805

Comments:

Riverbank Army Ammunitions Plant is an operating manufacturer of grenades and formerly produced aluminum sheeting and various ammunitions. The site is 173 acres and includes various plant facilities, a landfill, and evaporation/percolation (E/P) ponds. The surrounding area is primarily rural and the north section is bordered by the Stanislaus River.

As a result of the aluminum manufacturing process, the landfill was filled with pot liner containing cyanide. Cyanide leached into the groundwater aquifer. The remaining soil did not have high levels of contaminants- but the fragments of pot liner were removed anyway. The landfill was covered with a RCRA equivalent cap and seeded with native grasses to prevent rain from soaking into the landfill and leaching more contaminants into the groundwater as well as limit direct contact with soils.

The E/P ponds located on the banks of the Stanislaus River had high levels of zinc. They were excavated with care, as Phase I Ecological Risk Assessment identified the area as healthy riparian habitat supporting various aquatic and terrestrial organisms. A list can be found in the FS.

Chromium, primarily in the hexavalent form, and cyanide are the primary groundwater contaminants. Groundwater is pumped and treated to non-detect levels ($<10\mu g/L$) and the effluent is discharged to either the sanitary system drainage or the E/P ponds. As of the last review, the Army was looking into ways to approach the recharging A zone aquifer, which was not being treated as it was dry. A zone soils are contaminated, but at 30 feet bgs they are not expected to be disturbed and do not represent a future exposure pathway.

One possible concern is the use of a few open off-site wells for irrigation. Flora watered with contaminated water may represent a complete exposure pathway. Other wells, used for residential use, have been closed or are used for monitoring. Also, it had been assumed that current plant operations would continue, so no future use risks were considered. However, Riverbank Army Ammunitions Plant has been approved for closure by the 2005 BRAC committee.

Attachment 6

Interview Reports

INTERVIEW RECORD

Site Name: Riverbank Army Ammunition Plant		**EPA ID No.:**
Subject: County controls on groundwater use	**Time:** 1100	**Date:** 5-25-11
Type: √ Telephone ☐ Visit ☐ Other **Location of Visit:**	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Patrick Plumb	**Title:** Environmental Engineer	**Organization:** USACE

Individual Contacted:

Name: Nicole Damin	**Title:** Environmental Resources	**Organization:** Stanislaus County
Telephone No: 209-525-6725 **Fax No:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**	

Summary Of Conversation

Ms. Damin is in the Environmental Resources Department of Stanislaus County.

Ms. Damin stated that applications for groundwater use within the county are screened for proximity to areas of known contamination. Ahtna quarterly groundwater monitoring reports are reviewed to determine areas of known contamination. Applications for domestic water wells within 500 to 1,000 feet of RBAAP will be denied. Domestic water well applications from RBAAP west to Terminal Avenue will be denied. Applications for irrigation wells will be considered individually.

Ms. Damini stated that the county has not received a water well application in the RBAAP area in approximately 10 years. She thought this was because domestic use is increasing in the area as new homes are built, and they are connected to the municipal water system. To her knowledge, the county has not received any complaints recently regarding groundwater issues near RBAAP. Regarding site management, she suggested that periodic mailings be used to keep local residents informed of site developments.

INTERVIEW RECORD

Site Name: Riverbank Army Ammunition Plant		**EPA ID No.:**
Subject:	**Time:**	**Date:** 5-11-11
Type: ☐ Telephone √ Visit ☐ Other **Location of Visit:**	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Patrick Plumb Heather Jackson	**Title:** Environmental Engineer Environmental Engineer	**Organization:** USACE

Individual Contacted:

Name: Clark Hunt	**Title:** Safety Specialist	**Organization:** Army
Telephone No: **Fax No:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**	

Summary Of Conversation

Mr. Hunt's official title is Security and Safety Specialist and COR for the project. However, there are currently no contracts in place for him to function as the COR, and he has no contracts or responsibilities for the site at present.

Mr. Hunt stated that Ahtna is responsive and is doing a super job. He provides safety support. The City has been difficult to deal with during the transfer, and his view is that the community feels that the plant clean-up is taking a long time. The Army wants to retain exclusive use of the plant. Arrangements are needed for long-term monitoring of groundwater. The FOSET may address ICs.

INTERVIEW RECORD

Site Name: Riverbank Army Ammunition Plant	**EPA ID No.:**	
Subject:	**Time:**	**Date:** 5-11-11
Type: ☐ Telephone √ Visit ☐ Other **Location of Visit:**	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Patrick Plumb Heather Jackson	**Title:** Environmental Engineer Environmental Engineer	**Organization:** USACE

Individual Contacted:

Name: Joseph Valenzuela	**Title:** Environmental Technician	**Organization:** Ahtna
Telephone No: **Fax No:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**	

Summary Of Conversation

Mr. Valenzuela is the Ahtna Plant Operator for the Riverbank AAP NPL site GWTP. He has been with Ahtna for almost one year. He also worked as the plant operator for 10 years for NI Industries when the plant first came online. He used to be able to get lab analysis done on site, but the facilities and staff are no longer available. The plant used to have seven operators, so it is harder to get maintenance done now that there is only one operator

Mr. Valenzuela stated that treatment has been effective and the plant is operating very well. The plant operates 24 hrs per day, seven days per week. Operator is present about 40 hrs per week, and as needed. The treatment system is automated with an alarm system. This happened when Ahtna took over for NI Industries. No major O&M changes in the last year, except improved landscaping. Normal maintenance. The plant is fully optimized and he has taken care of housekeeping details (such as black widows, pigeon droppings, weeds, etc.) since he returned to Riverbank. Ahtna is very good about safety and operation of the plant. Recently the door to the plant broke and it was taken care of right away. There are no other major issues at the site. Ahtna implements his recommendations on plant maintenance.

INTERVIEW RECORD

Site Name: Riverbank Army Ammunition Plant	**EPA ID No.:**	
Subject:	**Time:**	**Date:** 5-11-11
Type: ☐ Telephone √ Visit ☐ Other **Location of Visit:**	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Patrick Plumb Heather Jackson	**Title:** Environmental Engineer Environmental Engineer	**Organization:** USACE

Individual Contacted:

Name: Rachel Kerr	**Title:** Environmental Scientist	**Organization:** Ahtna
Telephone No: **Fax No:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**	

Summary of Conversation

Ms. Kerr is the Ahtna Project Manager for the Riverbank AAP NPL site. She has worked on the project since April 2008. Her overall impression of the project is that the current groundwater contamination treatment system is effective; however, now that there are fewer and smaller areas of contamination, the system is becoming less effective. She is excited about implementing the new in-situ treatment system. There have been improvements with well 63A' and more improvements are expected with the in-situ treatment.

Ms. Kerr stated that treatment has been effective. There are only small areas and few locations of contamination left. In-situ treatment is needed for removing remaining contamination. This is described in ESD#1, and will involve addition of corn syrup and ferrous sulfate. Institutional controls include deed restrictions as described in ESD#2. County controls also limit groundwater use. Cyanide above MCL remains only in well 63A'. Well 104C is on property where the owner has denied access and is no longer available. Currently well 52C is operating 8 hours/day due to computer communication issues. Chromium is sometimes detected in monitoring wells 117A' and 65A'. Other wells to consider are 54B, 118B, 52C. Plant operates 24 hrs per day, seven days per week. Operator is present about 40 hrs per week, and as needed. There were no major O&M changes in last five years. In Jan. 2010, water was present in the communication lines, interrupting the system. This was fixed in July/Aug., 2010. Check with the county on groundwater use issue. There are no other major issues at the site.

INTERVIEW RECORD

Site Name: Riverbank Army Ammunition Plant		**EPA ID No.:**
Subject:	**Time:**	**Date:** 5-11-11
Type: ☐ Telephone √ Visit ☐ Other **Location of Visit:** RBAAP		☐ Incoming ☐ Outgoing

Contact Made By:

Name:	**Title:**	**Organization:**
Patrick Plumb	Environmental Engineer	USACE
Heather Jackson	Environmental Engineer	

Individual Contacted:

Name:	**Title:**	**Organization:**
Lewis Mitani	Remedial Project Manager	USEPA

Telephone No: **Fax No:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**

Summary Of Conversation

Mr. Mitani is US EPA's Remedial Project Manager of Record for the Riverbank AAP NPL site.

Mr. Mitani stated that as far as he can tell, everything is going well, and the only thing he is concerned about are the institutional controls (ICs). Long-term monitoring will be required. There has been routine communications between the Army and EPA, through the regular monitoring reports and as needed. Recent meetings have involved the ESDs and polishing the A and A' aquifer. No complaints or violations related to the site have been received by the EPA, and no violations have been issued, although EPA has authority through the Federal Facilities Agreement.

Mr. Mitani said he felt well informed about the site's activities and progress. Regarding suggestions, he stated that the Army could facilitate the process of automatic review of well applications from the county and the water board, and establish a zone of prohibition near areas of remaining contamination. ICs are discussed in ESD#2 for conveying land and property to the LRA. Mr. Mitani stated that the ICs "have to be fleshed out", including the post-closure use of off-site wells and the Army's right of access to the landfill and to wells on private property. A base-wide master plan addressing ICs needs to be developed. There are no other major issues at the site.

INTERVIEW RECORD

Site Name: Riverbank Army Ammunition Plant	**EPA ID No.:**	
Subject: RBAAP Five-Year Review	**Time:** 1430	**Date:** 6-2-11
Type: √ Telephone ☐ Visit ☐ Other **Location of Visit:**	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Patrick Plumb	**Title:** Environmental Engineer	**Organization:** USACE

Individual Contacted:

Name: Robert Smith	**Title:** Base Environmental Coordinator	**Organization:** US Army

Telephone No: 209-869-7274 **Fax No:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**

Summary Of Conversation

Mr. Smith is the Base Commander's Representative and the Base Environmental Coordinator, and has been for the last 2.5 years. He is one of two Army personnel left at RBAAP. Mr. Smith stated that his overall impression of the work is that a well-established routine is successfully cleaning up the site and the contractor, Ahtna, is doing an excellent job.

Difficulties have included lack of continuity in Army personnel due to the BRAC process, which has resulted in Army personnel with extensive site experience leaving RBAAP. This has led to poor communications at times with USACE and difficulties in contracting services. Contracts that had taken a few weeks by the Army Rock Island contracting took a few months with the bidding process used by the USACE. One example of this occurred in 2009 when the operator's contract lapsed and work at the GWTP was stopped. This also caused a delay in the production of the ESDs. Another problem occurred when access to extraction wells west of RBAAP was denied because the property owner said they were not paid for access.

Control for the site has been turned over to the LRA, and the transfer is proceeding. Galbestos is an issue at RBAAP, and is slowing the FOST and FOSET, but is not present on the NPL portion of the site.

Institutional controls are being handled through ESD #2. In-situ treatment is being handled through ESD #1.

Another issue is that the discharge from the GWTP goes through the IWTF with its RCRA Part B permit. When the IWTF is closed, it is not clear if the GWTP will be able to discharge directly to the E/P ponds.

Attachment 7

Groundwater Trend Analysis

Both the Mann-Kendall test and Sen Slope statistics were performed to provide the primary evaluation of well trends. Linear regression analysis was also performed as an illustrative graphic of the time versus concentration relationship and to show calculated confidences and prediction intervals.

The various statistical models and parameters used in the assessment are discussed below.

Linear regression

Linear Regression examines the relationship between concentration and time, with several statistical parameters used to determine significance:

Slope (b1)

Slope is the slant of the regression line. It is the change in Y (chromium or cyanide concentration) that occurs when X increases by one unit (date of next sampling event).

Coefficient p-values (P)

The coefficient value for P (p-value) indicates whether or not the association between the response and predictor(s) is statistically significant. If the p-value is smaller than the α-level selected, the association is statistically significantly. A commonly used α-level is 0.05 (95% confidence level) so if the p-value is less than 0.05 then the equation is statistically significant.

Prediction intervals (PI)

Illustrate the range of likely values for new observations (values for chromium or cyanide). They represent a series of prediction intervals that span the range of observed values (known chromium or cyanide concentrations from sampling and analysis).

Confidence intervals (CI)

Confidence intervals are used to indicate the reliability of an estimate. How likely the interval is to contain the parameter is determined by the confidence level or confidence coefficient. A confidence interval is always qualified by a particular confidence level, usually expressed as a percentage; for example a "95% confidence interval" was used to evaluate the RBAAP groundwater data. The end points of the confidence interval are referred to as confidence limits.

For a given estimation procedure, the higher the confidence level, usually the wider the confidence interval will be. A 95% confidence interval does not mean that there is a 95% probability that the interval contains the true mean. The interval computed from a given sample either contains the true mean or it does not. Instead, the level of confidence is associated with the method of calculating the interval. The confidence coefficient is simply the proportion of samples of a given size that may be expected to contain the true mean. That is, for a 95% confidence interval, if many samples are collected and the confidence interval computed, in the long run about 95% of these intervals would contain the true mean.

Mann-Kendall Test

The Mann-Kendall test is a signed rank test and assumes no particular distribution for the data, that is, it doesn't have to be normally distributed. It is based on the difference between the numbers of pair-wise differences (number of positive signs minus the number of negative). If the difference is a large positive value, then there is evidence of an increasing trend in the data and if it is a large negative value, then there is evidence of a decreasing trend. The baseline condition for this test (null hypothesis) is that there is no temporal (time) trend in the data values. The alternative hypothesis is that of either an upward trend or a downward trend. The null hypothesis (there is no trend) is rejected when the computed Z value is greater than $Z\alpha$ where α is the level of statistical significance.

The Mann-Kendall test is used for detecting trends in data collected over time. An adjustment is made for tied observations in this non-parametric test. You must have at least 10 observations for the normal approximation to be appropriate. Normal approximation is often used to test the difference between scores of data where the central point under the null hypothesis would be expected to be zero. Scores exactly equal to the central point are excluded and the absolute values of the deviations from the central point of the remaining scores are ranked such that the smallest deviation has a rank of 1. Tied scores are assigned a mean rank. The sums for the ranks of scores with positive and negative deviations from the central point are then calculated separately. A value S is defined as the smaller of these two rank sums. S is then compared to a table of all possible distributions of ranks to calculate p, the statistical probability of attaining S from a population of scores that is symmetrically distributed around the central point. S is measured in the units of the response variable and represents the standard distance data values fall from the regression line. Normally the better the equation predicts the response, the lower the value for S.

As the number of scores used, n, increases, the distribution of all possible ranks S tends towards the normal distribution. So although for $n \leq 20$, exact probabilities would usually be calculated, for $n > 20$, the normal approximation is used. The recommended cutoff varies some use 20 although some put it lower (10) or higher (25). Minitab calculates the Mann-Kendall trend test by normal approximation at for data where $n > 10$.

Z-value

The z-value measures how far an observation lies from its mean in units of standard deviation. Converting an observation to a z-value is called standardization. To standardize an observation in a population, subtract the population mean from the observation of interest and divide the result by the population standard deviation. The product of these operations is the z-value associated with the observation of interest. As discussed above there is no trend when the computed z value is greater than $z\ \alpha$ where α is the level of statistical significance (for definition statistical significance see coefficient p-values above).

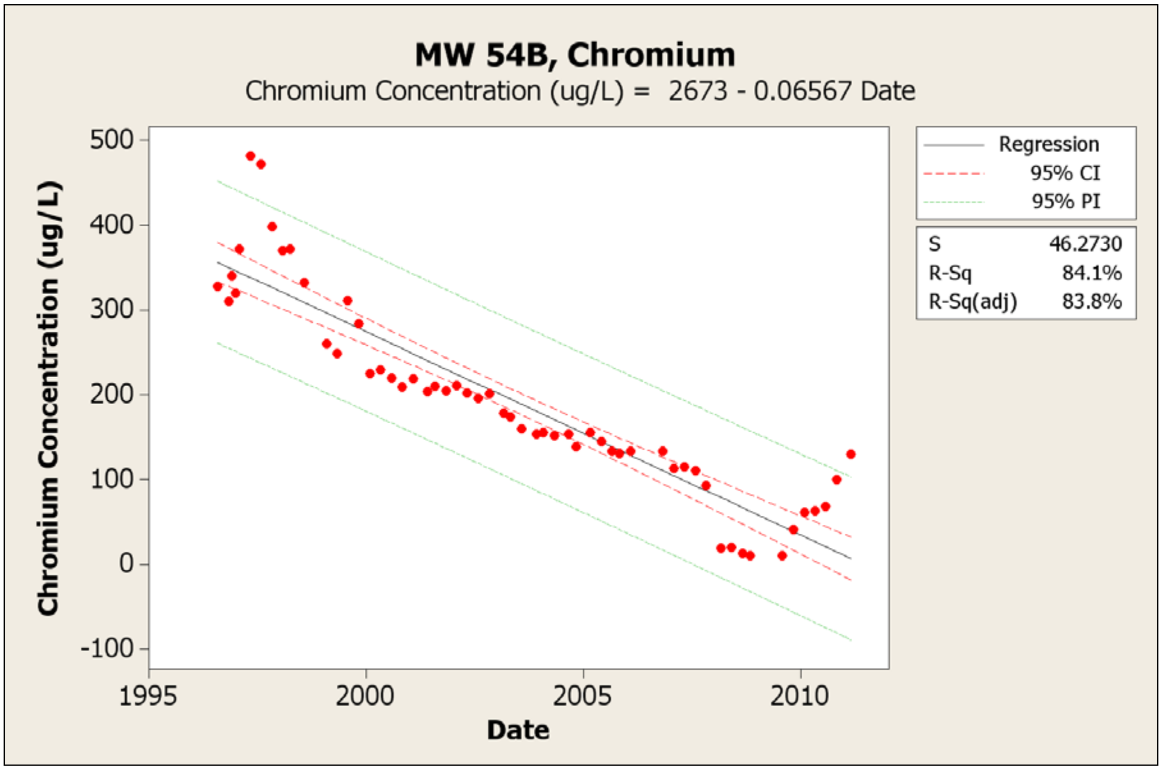
Sen's Slope

Sen's slope is an alternative for estimating a slope. This approach involves computing slopes for all the pairs of time points and then using the median of these slopes as an estimate of the overall slope. If there is no underlying trend, there will be an approximately equal number of positive and negative slopes, and thus the median will be near zero Sen's slope provides an estimate of the slope (unit change i.e. concentration of chromium or cyanide per time period) or the magnitude of the trend.

Results of statistical analysis of monitoring well concentration trends are given in below.

RBAAP MONITORING WELL 54B

Fitted Line: concentration versus time



Notes: CI = Confidence Interval
PI = Prediction Interval

Data:

Date	Concentration(μg/L)
8/1996	328
11/1996	310
12/1996	340
1/1997	320
2/1997	372
5/1997	482
8/1997	472
11/1997	398
2/1998	370
4/1998	372
8/1998	332
2/1999	260
5/1999	249
8/1999	311
11/1999	284

2/2000	225
5/2000	229
8/2000	220
11/2000	209
2/2001	219
6/2001	204
8/2001	210
11/2001	205
2/2002	211
5/2002	202
8/2002	196
11/2002	201
3/2003	178
5/2003	174
8/2003	160
12/2003	154
2/2004	155
5/2004	152
9/2004	154
11/2004	139
3/2005	155
6/2005	145
9/2005	133
11/2005	131
2/2006	133
11/2006	133
2/2007	113
5/2007	115
8/2007	110
11/2007	93
3/2008	19
6/2008	20
9/2008	13
11/2008	10
8/2009	10
11/2009	41
2/2010	61
5/2010	63
8/2010	68
11/2010	100
3/2011	130

Regression Analysis: Chromium Concentration (µg/L) versus Date

The regression equation is
Chromium Concentration (µg/L) = 2673 - 0.0657 Date
S = 46.2730   R-Sq = 84.1%   R-Sq(adj) = 83.8%

Mann-Kendall Trend Test by Normal Approximation

Ho: No trend in Chromium Concentration (µg/L)

The calculated z = -9.27438

For Ha: Upperward trend, the p-value = 1
At alpha = 0.05, there is not enough evidence to determine that there is an upward trend.

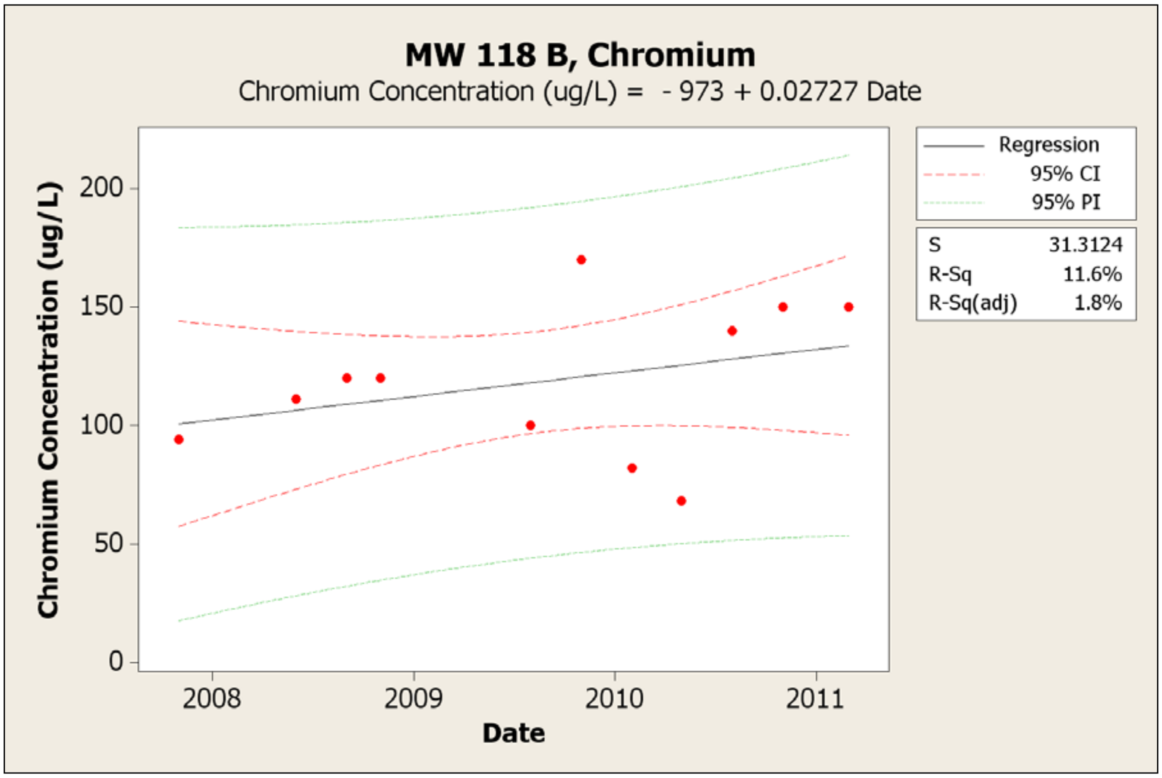
For Ha: Downward trend, the p-value = 0.0000000
At alpha = 0.05, there is enough evidence to determine that there is a downward trend.

Sen's Slope

Sen's Slope for Chromium Concentration (µg/L) = -5.625
Sen's Slope for Chromium Concentration (µg/L-yr) = -21.4 µg/L-yr

RBAAP MONITORING WELL 118B

Fitted Line: concentration versus time



Notes: CI = Confidence Interval
PI = Prediction Interval

Data:

Date	Concentration(µg/L)
11/2007	94
6/2008	111
9/2008	120
11/2008	120
8/2009	100
11/2009	170
2/2010	82
5/2010	68
8/2010	140
11/2010	150
3/2011	150

Regression Analysis: Chromium Concentration (µg/L) versus Date

The regression equation is
Chromium Concentration (µg/L) = - 973 + 0.02727 Date
S = 31.3124   R-Sq = 11.6%   R-Sq(adj) = 1.8%

Mann-Kendall Trend Test by Normal Approximation

Ho: No trend in TCE Concentration (µg/L)

The calculated z = 1.78885

For Ha: Upperward trend, the p-value = 0.0368191
At alpha = 0.05, there is enough evidence to determine that there is an upward trend.

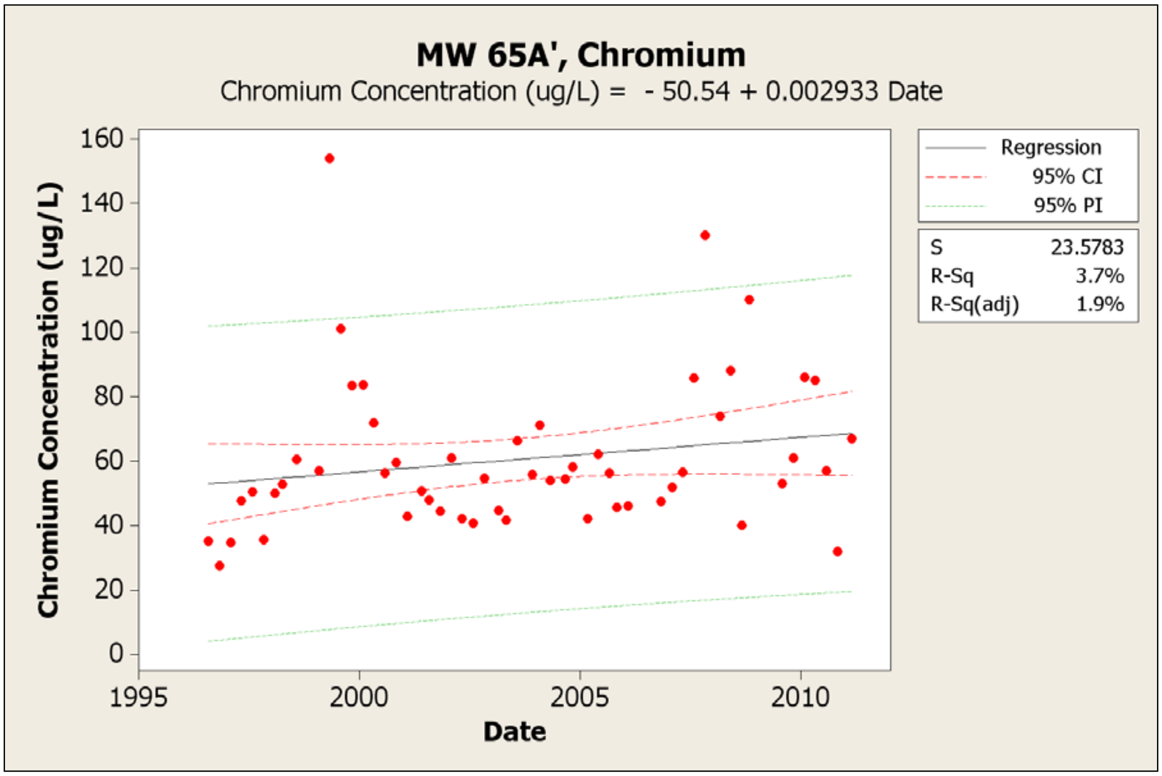
For Ha: Downward trend, the p-value = 0.963181
At alpha = 0.05, there is not enough evidence to determine that there is a downward trend.

Sen's Slope

Sen's Slope for Chromium Concentration (µg/L) = 4.28571
Sen's Slope for Chromium Concentration (µg/L-yr) = 13.5 µg/L-yr

RBAAP MONITORING WELL 65A’

Fitted Line: concentration versus time



Notes: CI = Confidence Interval
PI = Prediction Interval

Data:

Date	Concentration(μg/L)
8/1996	35.1
11/1996	27.6
2/1997	34.6
5/1997	47.6
8/1997	50.5
11/1997	35.5
2/1998	50
4/1998	52.8
8/1998	60.5
2/1999	57
5/1999	154
8/1999	101
11/1999	83.5
2/2000	83.6
5/2000	71.9
8/2000	56.3

11/2000	59.6
2/2001	42.8
6/2001	50.7
8/2001	47.9
11/2001	44.5
2/2002	60.8
5/2002	42.1
8/2002	40.7
11/2002	54.7
3/2003	44.7
5/2003	41.6
8/2003	66.2
12/2003	55.7
2/2004	71.2
5/2004	53.9
9/2004	54.4
11/2004	58.1
3/2005	42
6/2005	62
9/2005	56.2
11/2005	45.6
2/2006	46
11/2006	47.4
2/2007	51.8
5/2007	56.5
8/2007	85.8
11/2007	130
3/2008	74
6/2008	88
9/2008	40
11/2008	110
8/2009	53
11/2009	61
2/2010	86
5/2010	85
8/2010	57
11/2010	32
3/2011	67

Regression Analysis: Chromium Concentration (µg/L) versus Date

The regression equation is
Chromium Concentration (µg/L) = - 50.54 + 0.002933 Date
S = 23.5783   R-Sq = 3.7%   R-Sq(adj) = 1.9%

Mann-Kendall Trend Test by Normal Approximation

Ho: No trend in Chromium Concentration (µg/L)

The calculated z = 2.11135

For Ha: Upperward trend, the p-value = 0.0173710

At alpha = 0.05, there is enough evidence to determine that there is an upward trend.

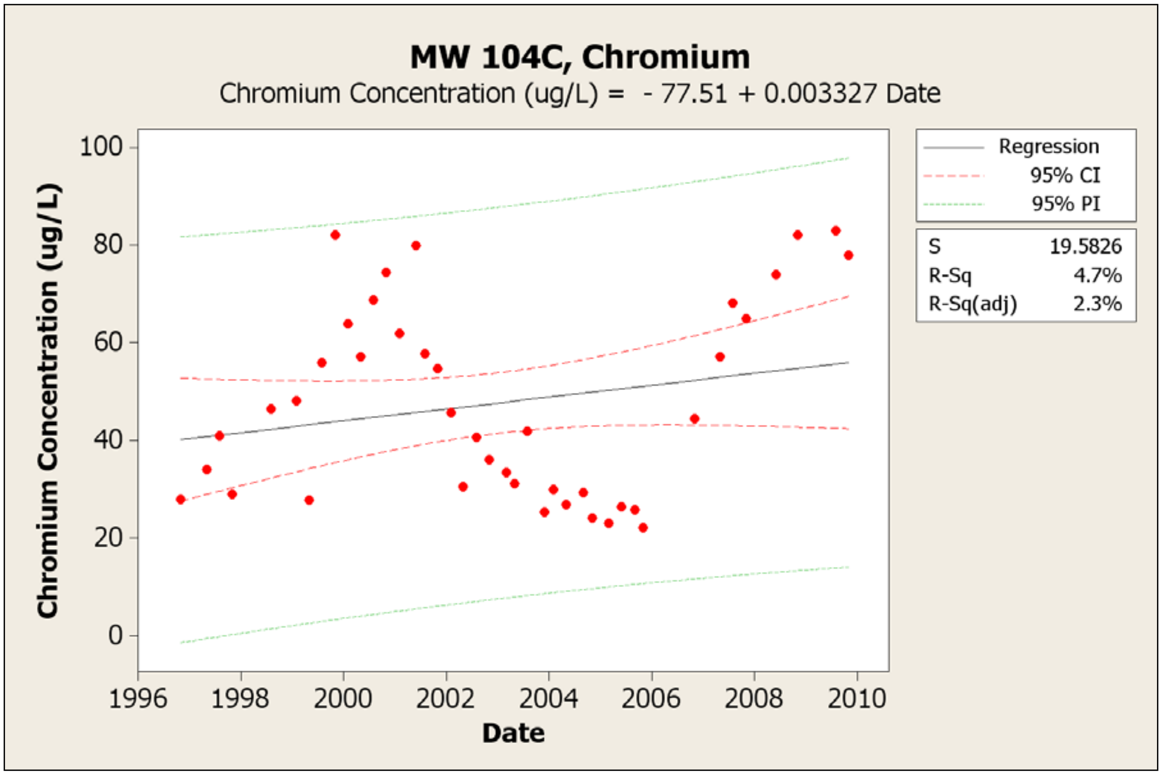
For Ha: Downward trend, the p-value = 0.982629
At alpha = 0.05, there is not enough evidence to determine that there is a downward trend.

Sen's Slope

Sen's Slope for Chromium Concentration (µg/L) = 0.308696
Sen's Slope for Chromium Concentration (µg/L-yr) = 1.4 µg/L-yr

RBAAP MONITORING WELL 104C

Fitted Line: concentration versus time



Notes: CI = Confidence Interval
PI = Prediction Interval

Data:

Date	Concentration(μg/L)
11/1996	28
5/1997	34
8/1997	41
11/1997	29
8/1998	46.4
2/1999	48.1
5/1999	27.8
8/1999	56
11/1999	82
2/2000	63.9
5/2000	57.1
8/2000	68.7
11/2000	74.4
2/2001	61.9
6/2001	80
8/2001	57.8

11/2001	54.7
2/2002	45.7
5/2002	30.5
8/2002	40.6
11/2002	36
3/2003	33.4
5/2003	31.1
8/2003	41.8
12/2003	25.3
2/2004	29.9
5/2004	26.9
9/2004	29.4
11/2004	24.2
3/2005	23.1
6/2005	26.4
9/2005	25.8
11/2005	22.1
11/2006	44.5
5/2007	57.1
8/2007	68.1
11/2007	65
6/2008	74
11/2008	82
8/2009	83
11/2009	78

Regression Analysis: Chromium Concentration (µg/L) versus Date

The regression equation is
Chromium Concentration (µg/L) = - 77.51 + 0.003327 Date
S = 19.5826   R-Sq = 4.7%   R-Sq(adj) = 2.3%

Mann-Kendall Trend Test by Normal Approximation

Ho: No trend in TCE Concentration (µg/L)

The calculated z = 0

For Ha: Upperward trend, the p-value = 0.5
At alpha = 0.05, there is not enough evidence to determine that there is an upward trend.

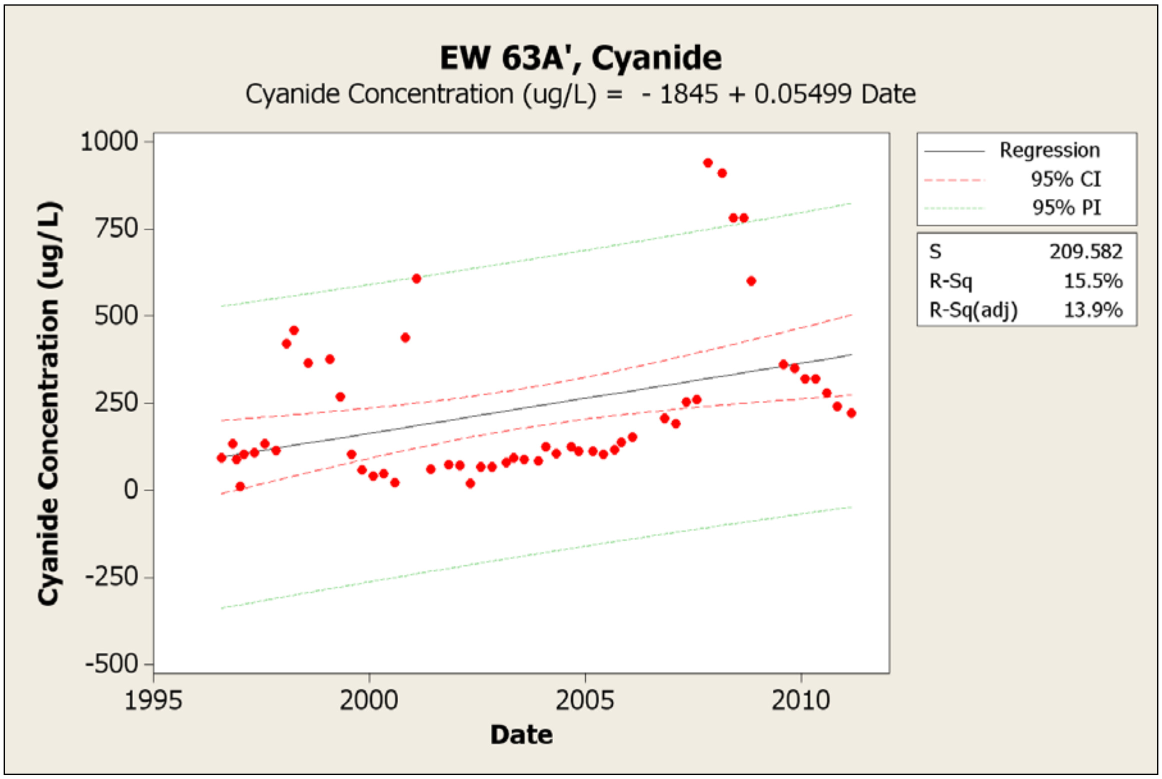
For Ha: Downward trend, the p-value = 0.5
At alpha = 0.05, there is not enough evidence to determine that there is a downward trend.

Sen's Slope

Sen's Slope for Chromium Concentration (µg/L) = 0
Sen's Slope for Chromium Concentration (µg/L-yr) = 0 µg/L-yr

RBAAP EXTRACTION WELL 63A'

Fitted Line: concentration versus time



Notes: CI = Confidence Interval
PI = Prediction Interval

Data:

Date	Concentration(µg/L)
8/1996	91.4
11/1996	133
12/1996	89
1/1997	10
2/1997	102
5/1997	108
8/1997	132
11/1997	114
2/1998	420
4/1998	459
8/1998	365
2/1999	376
5/1999	268
8/1999	104
11/1999	57
2/2000	41

5/2000	47
8/2000	22
11/2000	438
2/2001	607
6/2001	60
11/2001	73
2/2002	70
5/2002	20
8/2002	66
11/2002	67
3/2003	79
5/2003	93
8/2003	88.3
12/2003	83
2/2004	125
5/2004	106
9/2004	125
11/2004	112
3/2005	111
6/2005	104
9/2005	116
11/2005	138
2/2006	153
11/2006	206
2/2007	192
5/2007	254
8/2007	259
11/2007	940
3/2008	910
6/2008	780
9/2008	780
11/2008	600
8/2009	360
11/2009	350
2/2010	320
5/2010	320
8/2010	280
11/2010	240
3/2011	220

Regression Analysis: Cyanide Concentration (µg/L) versus Date

The regression equation is
Cyanide Concentration (µg/L) = - 1845 + 0.05499 Date
S = 209.582   R-Sq = 15.5%   R-Sq(adj) = 13.9%

Mann-Kendall Trend Test by Normal Approximation

Ho: No trend in Cyanide Concentration (µg/L)

The calculated z = 3.68824

For Ha: Upperward trend, the p-value = 0.0001129

At alpha = 0.05, there is enough evidence to determine that there is an upward trend.

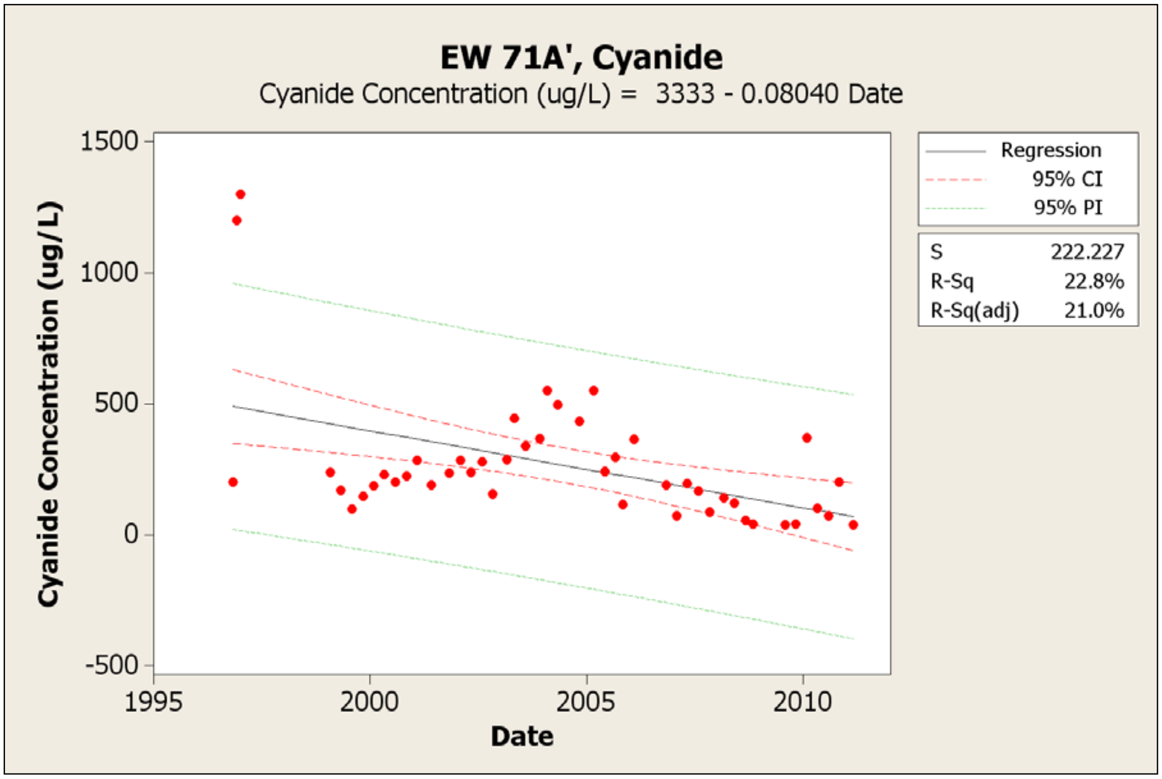
For Ha: Downward trend, the p-value = 0.999887
At alpha = 0.05, there is not enough evidence to determine that there is a downward trend.

Sen's Slope

Sen's Slope for Cyanide Concentration (µg/L) = 4.25
Sen's Slope for Cyanide Concentration (µg/L-yr) = 15.8 µg/L-yr

RBAAP EXTRACTION WELL 71A'

Fitted Line: concentration versus time



Notes: CI = Confidence Interval
PI = Prediction Interval

Data:

Date	Concentration(μg/L)
11/1996	200
12/1996	1200
1/1997	1300
2/1999	239
5/1999	169
8/1999	98
11/1999	147
2/2000	186
5/2000	231
8/2000	202
11/2000	225
2/2001	283
6/2001	191
11/2001	236
2/2002	285
5/2002	238
8/2002	278

11/2002	155
3/2003	287
5/2003	445
8/2003	339
12/2003	367
2/2004	550
5/2004	496
11/2004	432
3/2005	549
6/2005	241
9/2005	296
11/2005	116
2/2006	363
11/2006	191
2/2007	72
5/2007	194
8/2007	166
11/2007	87
3/2008	140
6/2008	120
9/2008	54
11/2008	40
8/2009	38
11/2009	40
2/2010	370
5/2010	100
8/2010	72
11/2010	200
3/2011	38

Regression Analysis: Cyanide Concentration (µg/L) versus Date

The regression equation is
Cyanide Concentration (µg/L) = 3333 - 0.08040 Date
S = 222.227   R-Sq = 22.8%   R-Sq(adj) = 21.0%

Mann-Kendall Trend Test by Normal Approximation

Ho: No trend in Cyanide Concentration (µg/L)

The calculated z = -2.56644

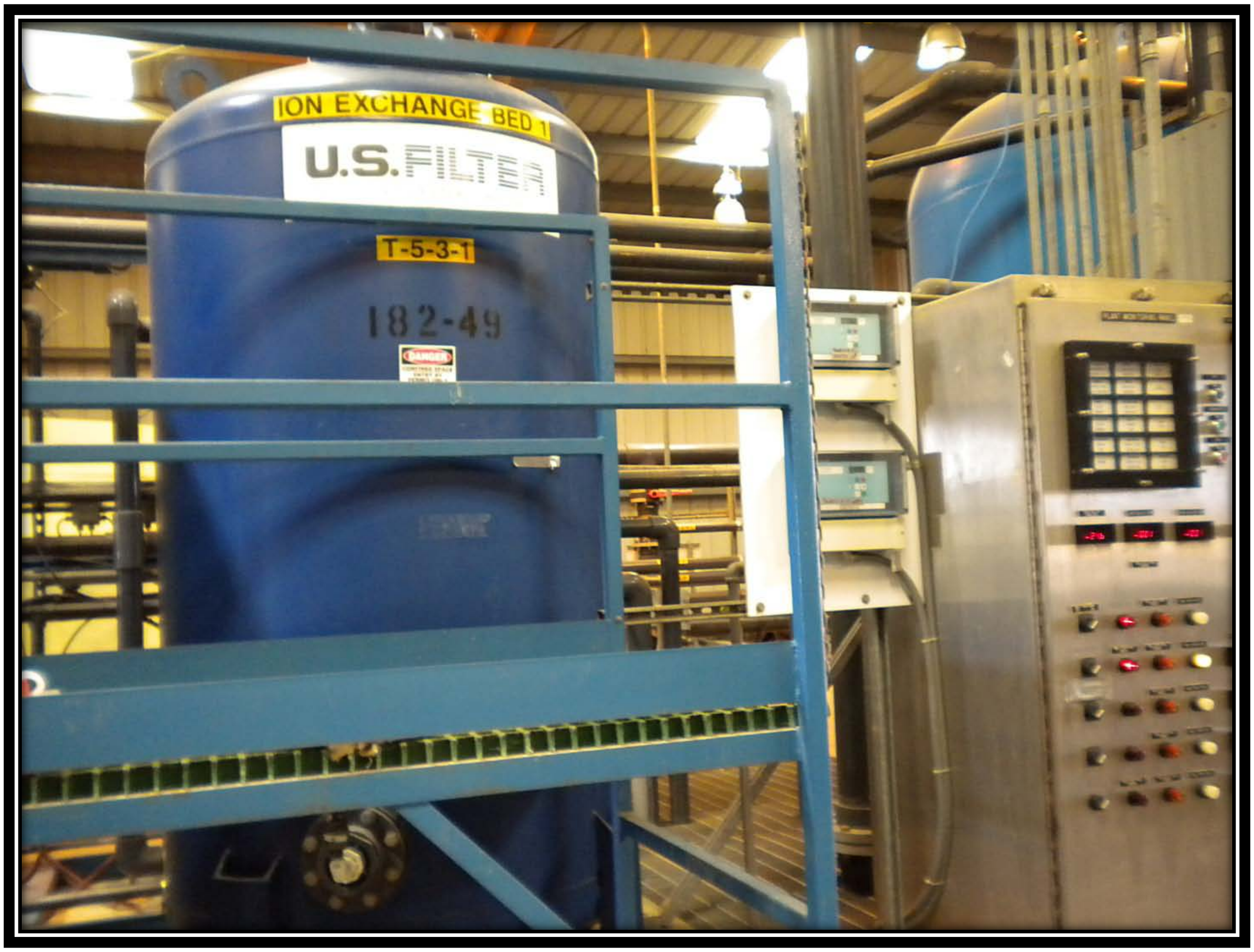
For Ha: Upperward trend, the p-value = 0.994863
At alpha = 0.05, there is not enough evidence to determine that there is an upward trend.

For Ha: Downward trend, the p-value = 0.0051374
At alpha = 0.05, there is enough evidence to determine that there is a downward trend.

Sen's Slope
Sen's Slope for Cyanide Concentration (µg/L) = -3.96429
Sen's Slope for Cyanide Concentration (µg/L-yr) = -12.6 µg/L-yr

Attachment 8

Site Inspection Photos



GWTP: Ion exchange bed and control panel.

GWTP: Surge tank, ion exchange unit, process piping and controls.

GWTP: Treated water holding tanks.

Landfill Monitoring Well GW5C and Landfill, facing NE.

West side of landfill, facing NE.

South side of landfill, facing NW.

East side of landfill, with fence and rodent traps, facing N.

IWTP: Treated water holding basin.

Extraction Well EW63A’ control panel.

Extraction Well EW54B.

E/P Pond, facing W.

Attachment 9

Groundwater Monitoring Data

Well ID	Zone	1st Quarter 2011		4th Quarter 2010		3rd Quarter 2010		2nd Quarter 2010		1st Quarter 2010	
		Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)
MW5A'	A'	NSS	NSS	ND	24 J	NSS	NSS	ND (ND)	ND	NSS	NSS
MW5B	B	NSS	NSS	NSS	NSS	NSS	NSS	ND	ND	NSS	NSS
MW9A	A	NSS	NSS	NSD	NSD	NSS	NSS	NSI	NSI	NSS	NSS
MW12A	A	NSS	NSS	NSS	NSS	NSS	NSS	NSI	NSI	NSS	NSS
MW13A	A	NSS	NSS	NSS	NSS	NSS	NSS	NSI	NSI	NSS	NSS
MW14A	A	NSS	NSS	NSS	NSS	NSS	NSS	NSI	NSI	NSS	NSS
MW14A'	A'	NSS	NSS	ND	16 J	NSS	NSS	ND	ND	NSS	NSS
MW15A	A	NSS	NSS	NSD	NSD	NSS	NSS	NSI	NSI	NSS	NSS
MW16A	A	NSS	NSS	NSI	NSI	NSS	NSS	NSI	NSI	NSS	NSS
MW17A	A	NSS	NSS	NSS	NSS	NSS	NSS	NSI	NSI	NSS	NSS
MW17A'	A'	NSS	NSS	ND	ND	NSS	NSS	11	ND	NSS	NSS
MW18A	A	NSS	NSS	NSI	NSI	NSS	NSS	NSI	NSI	NSS	NSS
MW19A	A	NSS	NSS	NSS	NSS	NSS	NSS	NSI	NSI	NSS	NSS
MW20A	A	NSS	NSS	NSI	NSI	NSS	NSS	NSI	NSI	NSS	NSS
MW21A	A	NSS	NSS	NSS	NSS	NSS	NSS	NSI	NSI	NSS	NSS
MW34A'	A'	12	NSS	12	NSS	12	NSS	13	ND	16	ND
MW34B	B	NSS	NSS	NSS	NSS	NSS	NSS	ND	ND	NSS	NSS
MW41A'	A'	NSS	NSS	NSS	NSS	NSS	NSS	NSI	NSI	NSS	NSS
MW45A'	A'	NSS	NSS	ND	NSS	NSS	NSS	ND	ND	NSS	NSS
MW45B	B	NSS	NSS	NSS	NSS	NSS	NSS	ND	11	NSS	NSS
MW46A	A	NSS	NSS	NSI	NSS	NSS	NSS	NSI	NSI	NSI	NSI
EW47C	C	NSS	NSS	NSS	NSS	NSS	NSS	ND	ND	NSS	NSS
MW49A	A	NSI	NSI	NSI	NSI	NSI	NSI	NSI	NSI	NSI	NSI
MW50A	A	NSS	NSS	NSI	NSI	NSS	NSS	NSI	NSI	NSS	NSS
MW51A	A	NSI	NSI	NSI	NSI	NSS	NSS	NSI	NSI	NSI	NSI
MW52A	A	NSI	NSI	NSI	NSI	NSS	NSS	NSI	NSI	NSI	NSI
EW52B	B	NSS	NSS	NSS	NSS	NSS	NSS	ND	NSS	NSS	NSS
EW52C	C	ND (ND)	NSS	ND	NSS	**66**	NSS	**63**	ND	NSS	NSS
MW54A	A	NSS	NSS	NSD	NSD	NSS	NSS	NSI	NSI	NSS	NSS
EW54B	B	**130**	NSS	**100**	NSS	**68 (66)**	NSS	**63**	ND	**61**	NSS
EW54C	C	NSS	NSS	NSS	NSS	NSS	NSS	ND	19	NSS	NSS
MW62A'	A'	ND	NSS	ND	ND	ND	NSS	ND	50	ND	NSS
EW63A'	A'	NSS	**220**	ND (ND)	**240 (240)**	NSS	**280**	ND	**320**	NSS	**320**
MW65A'	A'	**67**	NSS	32	ND	**57**	NSS	**85**	ND	**86**	NSS
MW66B	B	NSS	NSS	16	NSS	NSS	NSS	17	NSS	NSS	NSS
MW66C	C	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
MW67D	D	NSS	NSS	NSS	NSS	NSS	NSS	ND (ND)	ND (ND)	NSS	NSS
EW69A'	A'	NSS	NSS	NSS	NSS	NSS	NSS	ND	ND	NSS	NSS
EW71A'	A'	NSS	38	ND	**200**	NSS	72	ND	100	NSS	**370**
EW72B	B	NSS	NSS	ND	61 J	NSS	NSS	ND	42	NSS	NSS
MW73A'	A'	NSS	NSS	ND	NSS	NSS	NSS	11	ND	NSS	NSS
MW74A'	A'	ND	NSS	ND	NSS	ND	NSS	ND	ND	ND	ND
MW102A'	A'	NSS	NSS	NSS	NSS	NSS	NSS	NSD	NSD	NSS	NSS
MW102B	B	NSS	NSS	NSS	NSS	NSS	NSS	ND	ND	NSS	NSS
MW102C	C	NSS	NSS	NSS	NSS	NSS	NSS	ND	ND	NSS	NSS
MW104A'	A'	NSS	NSS	NSA	NSA	NSS	NSS	NSA	NSA	NSS	NSS
EW104B	B	NSS	NSS	NSA	NSA	NSS	NSS	NSA	NSA	NSS	NSS
MW104C	C	NSA	NSS	NSA	NSA	NSA	NSS	NSA	NSA	NSA	NSS
MW104D	D	NSS	NSS	NSA	NSA	NSS	NSS	NSA	NSA	NSS	NSS
MW105A'	A'	NSS	NSS	ND	NSS	NSS	NSS	ND	ND	NSS	NSS
MW105B	B	NSS	NSS	11	NSS	NSS	NSS	10	ND	NSS	NSS
MW105C	C	NSS	NSS	36	NSS	NSS	NSS	38	ND (ND)	NSS	NSS
MW107A'	A'	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
MW107B	B	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
MW107C	C	NSS	NSS	ND	NSS	NSS	NSS	ND	ND	NSS	NSS
MW109A'	A'	NSS	NSS	13	12 J	NSS	NSS	18	16	NSS	NSS
MW109B	B	NSS	80	ND	64 J	NSS	72	ND (ND)	48 (40)	NSS	61
MW109C	C	NSS	ND	ND	ND	NSS	ND (ND)	ND	ND	NSS	ND

Well ID	Zone	1st Quarter 2011		4th Quarter 2010		3rd Quarter 2010		2nd Quarter 2010		1st Quarter 2010	
		Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)
MW109D	D	NSS	NSS	ND	ND	NSS	NSS	ND	ND	NSS	NSS
MW110A'	A'	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
MW110B	B	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS	NSS
MW111A'	A'	NSS	NSS	ND	ND	NSS	NSS	ND	15	NSS	NSS
MW111B	B	NSS	56 (54)	ND (ND)	27 J (18 J)	NSS	25	ND	39 (37)	NSS	48
MW111C	C	NSS	NSS	NSS	ND	NSS	NSS	ND	ND	NSS	NSS
MW112B	B	NSS	NSS	NSA	NSS	NSS	NSS	NSA	NSA	NSS	NSS
MW112C	C	NSS	NSS	NSA	NSS	NSS	NSS	NSA	NSA	NSS	NSS
EW113A'	A'	12	70	11 (12)	49 J (28 J)	10	94	ND (ND)	53 (57)	**62**	31
EW113B	B	ND	43	NSP	NSP	ND	34	ND	11	ND	ND
EW114B	B	NSA	NSS	NSA	NSA	NSA	NSS	NSA	NSA	NSA	NSA
EW114C	C	NSS	NSS	NSA	NSA	NSS	NSS	NSA	NSA	NSS	NSS
PW115A'	A'	NSA	NSA	ND	ND	NSA	NSS	ND	ND	11	NSS
PW115B	B	NSA	NSA	18	13 J	NSA	NSS	14	14	16	NSS
PW115C	C	NSS	NSS	ND	ND	NSS	NSS	ND	ND	NSS	NSS
PW116A'	A'	32	57	34	39 J	30	48	36 (35)	59 (47)	42	32 (36)
MW117A'	A'	**76**	ND	31	ND	26	ND	**68**	ND	**54**	ND
MW118B	B	**150**	ND	**150 (150)**	ND (ND)	**140**	ND	**68 (67)**	ND	**82 (76)**	ND
MW119A'	A'	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW120A'	A'	NSA	NSA	ND	ND	NS	ND	ND	ND	ND	ND
DW-76D	D	NSS	NSS	ND	ND	NSS	NSS	ND	ND	NSS	NSS
DW-77D	D	NSS	NSS	ND	ND	NSS	NSS	ND	ND	NSS	NSS
DW-79D	D	NSS	NSS	NSP	NSP	NSS	NSS	NSP	NSP	NSS	NSS
DW-90D	D	NSS	NSS	ND	ND	NSS	NSS	ND	ND	NSS	NSS
DW-91D	D	NSS	NSS	NSP	NSP	NSS	NSS	NSP	NSP	NSS	NSS

Notes: **Bold** = greater than the MCL ( ) = duplicate result NSS = No Sample Scheduled
NSD = Not sampled, DRY NSI = Insufficient water for sampling ND = Non Detected
NSA = Not sampled, access denied NSP = Not sampled, pump malfunction NS = Not Sampled
J = The analyte was positively identified, but the associated numerical value is an approximate concentration, greater than the Method Detection Limit (MDL) but less than the Practical Quantitation Limit (PQL).

4th Quarter 2009		3rd Quarter 2009		2nd Quarter 2009	1st Quarter 2009	4th Quarter 2008		3rd Quarter 2008	
Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	No Samples Collected	No Samples Collected	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)
ND	ND	ND	ND			ND	ND	NSS	NSS
NSS	NSS	ND	ND			NSS	NSS	NSS	NSS
NSS	NSS	NSD	NSD			NSD	NSD	NSS	NSS
NSS	NSS	NSS	NSS			NSS	NSS	NSS	NSS
NSS	NSS	NSS	NSS			NSS	NSS	NSS	NSS
NSS	NSS	NSS	NSS			NSS	NSS	NSS	NSS
ND	ND	ND	ND			ND	12	NSS	NSS
NSS	NSS	NSD	NSD			NSD	NSD	NSS	NSS
NSS	NSS	NSD	NSD			NSD	NSD	NSS	NSS
NSS	NSS	NSS	NSS			NSS	NSS	NSS	NSS
13 (12)	15 (ND)	12 (13)	15 (ND)			14 (15)	ND	NSS	NSS
NSS	NSS	NSD	NSD			NSD	NSD	NSS	NSS
NSS	NSS	NSS	NSS			NSS	NSS	NSS	NSS
NSS	NSS	NSI	NSI			NSI	NSI	NSS	NSS
NSS	NSS	NSS	NSS			NSS	NSS	NSS	NSS
22	NSS	14	ND			25	ND	22	NSS
NSS	NSS	ND	ND			NSS	NSS	NSS	NSS
NSS	NSS	NSS	NSS			NSS	NSS	NSS	NSS
ND	NSS	ND	ND			ND	ND	NSS	NSS
NSS	NSS	ND	22			NSS	NSS	NSS	NSS
NSI	NSI	NSI	NSI			NSI	NSI	NSS	NSS
NSS	NSS	ND	ND			NSS	NSS	NSS	NSS
NSI	NSI	NSI	NSI			NSI	NSI	NSI	NSI
NSS	NSS	NSI	NSI			NSI	NSI	NSS	NSS
NSI	NSI	NSI	NSI			NSI	NSI	NSI	NSI
NSI	NSI	NSI	NSI			NSI	NSI	NSI	NSI
NSS	NSS	12	NA			NSS	NSS	NSS	NSS
NSS	NSS	11	16			NSS	NSS	NSS	NSS
NSS	NSS	NSI	NSI			NSI	NSI	NSS	NSS
41	NSS	ND	ND			ND	ND	13	NSS
NSS	NSS	NSS	NSS			NSS	NSS	NSS	NSS
ND	32	ND	100			10	ND	ND	NSS
ND	350	ND	360			ND	600	NSS	780
61	ND	53	ND			110	ND	40	NSS
20	NSS	ND	NSS			25	ND	NSS	NSS
NSS	NSS	NSS	NSS			NSS	NSS	NSS	NSS
NSS	NSS	ND	ND			NSS	NSS	NSS	NSS
NSS	NSS	37	ND			NSS	NSS	NSS	NSS
ND	40	ND	38			7.9	40	NSS	54 (55)
ND	28	ND	33			ND	28	NSS	NSS
13	NSS	13	ND			19	ND	NSS	NSS
ND	NSS	ND	ND			ND	ND	ND	NSS
NSS	NSS	NSS	NSS			NSS	NSS	NSS	NSS
NSS	NSS	ND	ND			NSS	NSS	NSS	NSS
NSS	NSS	ND	ND			NSS	NSS	NSS	NSS
ND	ND	ND	ND			ND	ND	NSS	NSS
46	ND	47	ND			NSP	NSP	NSS	NSS
78	14	83	21			82	13	NSS	NSS
ND	ND	ND	ND			5.6	ND	NSS	NSS
ND	NSS	ND	ND			ND	ND	NSS	NSS
11	NSS	11	ND			9.4	ND	NSS	NSS
37	NSS	39	ND			33	ND	NSS	NSS
NSS	NSS	NSS	NSS			NSS	NSS	NSS	NSS
NSS	NSS	NSS	NSS			NSS	NSS	NSS	NSS
ND	NSS	ND	ND			5.1	ND	NSS	NSS
16	22	16	22			16	10	NSS	NSS
ND	49	NSP	NSP			9.4	160	NSS	120
ND	ND	ND	ND			5.4	ND	NSS	ND

4th Quarter 2009		3rd Quarter 2009		2nd Quarter 2009	1st Quarter 2009	4th Quarter 2008		3rd Quarter 2008	
Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	No Samples Collected	No Samples Collected	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)
ND	ND	ND	ND			7.1	ND	NSS	NSS
NSS	NSS	NSS	NSS			NSS	NSS	NSS	NSS
NSS	NSS	NSS	NSS			NSS	NSS	NSS	NSS
ND (ND)	ND (ND)	ND	ND			7.7	13	NSS	NSS
ND (ND)	44 (32)	13	57			ND	59	NSS	120
NSS	ND	ND	ND			ND	ND	NSS	NSS
ND	NSS	ND	ND			5.4	ND	NSS	NSS
ND	NSS	ND	ND			9.7 (10)	ND	NSS	NSS
ND	22	NSP	NSP			NSP	NSP	NSP	NSP
ND	ND	ND	11			NSP	NSP	NSP	NSP
NSP	NSP	70	ND			NSP	NSP	28 (27)	NSS
24	ND	24	ND			NSP	NSP	NSS	NSS
ND	ND	ND	ND			ND	ND	ND	NSS
17 (17)	ND (ND)	21 (21)	18 (13)			9.5 (9.5)	ND	14	NSS
ND	ND	ND	ND			6.4	ND	NSS	NSS
45	37	49	47			30	52	50	24
47	ND	33	ND			74	ND	60	ND
170	32	100	ND			120	ND	120	ND
ND (ND)	11 (30)	ND	11			9.5 (12)	10 (14)	6.4	14
ND	ND	ND	ND			ND	ND	ND	ND
ND	ND	ND	ND			9.1	ND	NSS	NSS
ND	ND	ND	ND			9.1	ND	NSS	NSS
NSP	NSP	NSP	NSP			NSP	NSP	NSS	NSS
ND	ND	ND	ND			8.1	ND	NSS	NSS
NSP	NSP	NSP	NSP			NSP	NSP	NSS	NSS

2nd Quarter 2008		1st Quarter 2008		4th Quarter 2007		3rd Quarter 2007		2nd Quarter 2007	
Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)
ND	ND	NS	NS	ND	ND	NS	NS	ND	ND
ND	ND	NS	NS	NS	NS	NS	NS	ND	ND
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
ND (ND)	27 (46)	NS	NS	ND	ND	NS	NS	NS	NS
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
NS	NS	NS	NS	NS	NS	NS	NS	177	ND
13	ND	NS	NS	5.9	ND	NS	NS	8.84	ND
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
16	36	36	ND	27	ND	12.9	NS	46.0	9.1
ND	ND	NS	NS	NS	NS	NS	NS	ND	ND
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
ND (ND)	ND (ND)	NS	NS	ND	ND	NS	NS	ND	ND
5.4	ND	NS	NS	NS	NS	NS	NS	ND	6.7
NS	NS	NS	NS	NS	NS	NS	NS	ND	8.1
ND	ND	NS	NS	NS	NS	NS	NS	ND	ND
NS	NS	NS	NS	150	ND	NS	NS	124 (122)	ND (ND)
NS	NS	NS	NS	NS	NS	NS	NS	ND	ND
NS	NS	NS	NS	NS	NS	98.6	ND	66.6	ND
NS	NS	NS	NS	230	ND	213 (213)	ND	269	ND
8.5	NS	NS	NS	NS	NS	NS	NS	ND	NS
ND	ND	NS	NS	NS	NS	NS	NS	ND	ND
NS	NS	NS	NS	NS	NS	NS	NS	13.1	ND
20	ND	19	ND	93	ND	110	NS	112 (115)	ND (ND)
ND	ND	NS	NS	NS	NS	110	NS	113	ND
ND	49	ND	ND	ND	ND	ND	NS	ND	16.3
ND	780 (700)	ND	910 (910)	5	940	NS	259.0	ND	254
88	ND	74	ND	130	ND	85.8	NS	56.5	9.9
23	NSS	NS	NS	13	ND	NS	NS	29.7	NS
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
9.3	ND	NS	NS	NS	NS	NS	NS	7.95	ND
31	ND	NS	NS	NS	NS	NS	NS	15.4	ND
8.3	120 (120)	ND	140	8	87	NS	166.0	7.87	194
ND (6.5)	18 (ND)	NS	NS	ND	25	NS	NS	5.43 (5.05)	72.9 (67.0)
14	ND	NS	NS	19	ND	NS	NS	ND (ND)	ND (ND)
ND	ND	8.1	ND	ND	ND	ND	NS	ND	ND
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
ND	ND	NS	NS	NS	NS	NS	NS	6.17	ND
11	ND	NS	NS	NS	NS	NS	NS	15.7	ND
ND	ND	NS	NS	ND	ND	NS	NS	ND	ND
41	ND	NS	NS	42	ND	41.7 (42.9)	NS	47.9	9.7
74	14	NS	NS	65	ND	68.1	NS	54.4 (57.1)	19.4 (16.4)
ND	ND	NS	NS	5	ND	NS	NS	5.64	ND
ND	ND	NS	NS	5.6	ND	NS	NS	5.66	16.3
9.1	ND	NS	NS	7.6	ND	NS	NS	8.23	ND
30	ND	NS	NS	24	ND	NS	NS	28.2	9.5
5.6	NS	NS	NS	ND	ND	NS	NS	NS	NS
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
5.2	ND	NS	NS	5.4	ND	NS	NS	5.92	ND
14	ND	NS	NS	13	ND	NS	NS	10.6	7.4
ND	110	ND	ND	ND	80	NS	69.5	ND (ND)	42.6 (43.4)
ND	ND (ND)	5.1	ND	ND	ND	NS	NS	5.05	ND

2nd Quarter 2008		1st Quarter 2008		4th Quarter 2007		3rd Quarter 2007		2nd Quarter 2007	
Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)
6.7 (6.5)	ND (ND)	NS	NS	7.7	ND	NS	NS	7.64	ND
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
7	24	NS	NS	10	16	NS	NS	5.93	37.8
ND	54	ND	53	6.2	21	NS	44.0	ND	68.5
ND	ND	NS	NS	ND	ND	NS	NS	ND	ND
ND	ND	NS	NS	ND	ND	NS	NS	ND	ND
7.2	ND	NS	NS	6.6	ND	NS	NS	5.93	5.2
NS	NS	NS	NS	NS	NS	12.6	35.3 (32.9)	14.6	32.4
NS	NS	NS	NS	NS	NS	NS	NS	12.6	14.2
46 (46)	ND	34	ND	20	ND	NS	NS	19.6	ND
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
ND (ND)	ND	ND (ND)	ND	ND	ND	13.9	NS	5.31	ND
7.0	ND	5.5	ND	36	ND	43.1	NS	**63.1**	8.9
6.1	ND	NS	NS	8.8	ND	NS	NS	7.86	ND
50	78	48	93	45	72	37.2	180.0	42.0	108
64	ND	NS	NS	**66**	ND	NS	NS	NS	NS
111	ND	NS	NS	**94**	ND	NS	NS	NS	NS
6.1	34	NS	NS	ND	32	NS	NS	NS	NS
11	ND	NS	NS	ND	ND	NS	NS	NS	NS
8.2	ND	NS	NS	ND	ND	NS	NS	9.21	ND
8.1	ND	NS	NS	ND	ND	NS	NS	9.01	ND
NS	NS	NS	NS	NS	NS	NS	NS	7.73	ND
7.3	ND	NS	NS	NS	NS	NS	NS	7.6	ND
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

1st Quarter 2007		4th Quarter 2006		3rd Quarter 2006	2nd Quarter 2006	1st Quarter 2006	
Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	No Samples Collected	No Samples Collected	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)
		5.0 U	5.0 U			NS	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
		5.0 U	17.8			NS	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
364	12.1	NS	NS			**58**	6.8
		6.19	5.0 U			NS	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
91.0		**89.1 (91.6)**	NS			**91.1**	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
		5.35	NS			NS	NS
		NS	NS			NS	NS
		5.36	NS			NS	NS
		NS	NS			NS	NS
132	15.0	**132**	5.0 U			**138**	7.8
		NS	NS			NS	NS
76.6	6.7	**85.5**	5.0 U			**90.8**	6.8
229	ND	**252**	5.0 U			**275 (279)**	5.1 (5.0 U)
		NS	NS			NS	NS
		NS	NS			NS	NS
		16.6	5.0 U			NS	NS
113		**117**	NS			**133**	NS
		NS	NS			NS	NS
ND		5.0 U	5.0 U			5.0 U	NS
	148 (192)	5.0 U	**206**			NS	153 (151)
49.0 (51.8)		47.4	5.0 U			46	NS
		25.6	NS			NS	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
	72.0	5.0 U	191 (187)			NS	**363**
		5.28	95.7			NS	NS
		5.0 U	NS			NS	NS
5.0 U		5.0 U (5.0 U)	NS			5.0 U (5.0 U)	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
		5.0 U	5.0 U			NS	NS
45.3		43.4	7.6			NS	NS
		44.5	6.7			NS	NS
		5.0 U	5.0 U			NS	NS
		5.72	NS			NS	NS
		13.9	NS			NS	NS
		30.9	NS			NS	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
		6.28	NS			NS	NS
		10.7	6.9			NS	NS
ND	60.4	NS	NS			NS	83.9
	9.3	5.61	5.0 U			NS	7.2

1st Quarter 2007		4th Quarter 2006		3rd Quarter 2006	2nd Quarter 2006	1st Quarter 2006	
Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)	No Samples Collected	No Samples Collected	Dissolved Chromium (µg/L)	Total Cyanide (µg/L)
		9.26	5.0 U (5.0 U)			NS	NS
		NS	NS			NS	NS
		NS	NS			NS	NS
		7.59 (7.27)	36.2 J (5.1 J)			7.35	NS
	45.1	5.0 U	45.6			NS	53.5
		NS	5.0 U			NS	NS
		5.0 U	NS			NS	NS
		5.0 U	NS			NS	NS
15.7	25.0	16	28.4			15.6	27
13.2	15.6	13.9	10.0			11.5	18.9
		NS	NS			15.9	NS
		NS	NS			NS	NS
(23.0) 21.5		10.1 (10.0)	5.0 U			**70.6**	NS
37.6		**51.8 (52.3)**	7.8			**46.1**	NS
		15.1	5.0 U			8.79	NS
34.5	147	36.9	144 (136)			14.4	77.5
		NS	NS			NS	NS
		9.50	5.0 U			NS	NS
		NS	NS			NS	NS
		8.11	5.0 U			NS	NS
		7.88	5.0 U			NS	NS
		NS	NS			NS	NS